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01 AERONAUTICS (GENERAL)

N76-28154* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 71, JUNE 1976
Jun. 1976 83 p
(NASA-SP-7037(71)) Avail: NTIS CSCL 01A

This bibliography lists 274 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1976. Author

N76-28155# Committee on Science and Technology (U. S. House).
THE FUTURE OF AVIATION, VOLUME 2
Washington GPO Jul. 1976 553 p refs Papers for Subcomm. on Aviation and Transportation R and D of Comm. on Sci. and Technol., 94th Congr., 2d Sess., Jul. 1976
(GPO-72-601) Avail: SOD HC $4.60

A comprehensive examination of the Future of Aviation was conducted in order to lay the basis for a national civil aviation research and development policy and in doing so to make a useful contribution to national transportation policy. In addition to 8 days of hearings, a number of invited papers were also solicited by the subcommittee and are included. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-28156 George Washington Univ., Washington, D.C.
A CLOSURE MODEL FOR CALCULATING THE DEVELOPMENT OF TURBULENT BOUNDARY LAYERS Ph.D. Thesis
Hsianmin Francort Jen 1976 111 p
Avail: Univ. Microfilms Order No. 76-15579

A set of turbulence model equations suitable for the calculation of the development of turbulent boundary layers with arbitrary pressure gradients is presented. In the turbulence model the flow quantities are determined from the solution of the Reynolds equations and transport equations for the turbulent kinetic energy, Reynolds shear stress, and turbulent energy dissipation. In the transport equations the turbulent diffusion terms are modeled in bulk-convection form. The bulk-convection diffusion model is obtained by considering the anology between the wake of a cylinder and the law of wake in a turbulent boundary layer. The empirical functions and constants used in the transport equations were selected by utilizing the concept of physical analogy among the transport equations. This model was applied to turbulent boundary layers with arbitrary pressure gradients. Dissert Abstr.

N76-28157 George Washington Univ., Washington, D.C.
NUMERICAL MODELING OF THE GROUND TURBULENT BOUNDARY LAYER BENEATH INTENSE VORTICES Ph.D. Thesis
Jiausen Jih 1976 129 p
Avail: Univ. Microfilms Order No. 76-16456

The incompressible turbulent flow with nonconstant viscosity in the ground boundary layer beneath an intense axisymmetrical vortex is studied. Equations of motion in cylindrical coordinates are derived in terms of the ratio of vorticity to radius, stream function and circulation. The Kolmogorov-Prandtl theory of turbulence is employed instead of the mixing-length theory to derive the turbulent kinetic energy equation. It is assumed that the length scales for turbulent momentum transfer and dissipation, and the diffusion constant, can be deduced from experimental data for two-dimensional flow on a solid wall. This is a plausible assumption because a correct theory of vortex flow must necessarily be reducible to two-dimensional flow for the case of large radius and zero circulation. The equations of motion and turbulent kinetic energy are generalized as second-order partial differential elliptic equations. The boundary conditions for each variable on each boundary are specified. Dissert. Abstr.

N76-28158*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GEARED-ELEVATOR FLUTTER STUDY
Charles L. Ruhlin, Robert V. Doggett, Jr., and Richard A. Gregory (Boeing Commercial Airplane Co., Seattle) May 1976 12 p refs Presented at AIAA/ASME/SAE 17th Struct., Structural Dyn., and Mater. Conf. Valley Forge, Pa., 5-7 May 1976
(NASA-TM-X-73902) Avail: NTIS HC $3.50 CSCL 01A

An experimental and analytical study was made of the transonic flutter characteristics of a supersonic transport tail assembly model having an all-movable, horizontal tail with a geared elevator. Two model configurations, namely, one with a gear-elevator (2.8 to 1.0 gear ratio) and one with locked-elevator (1.0 to 1.0 gear ratio), were flutter tested in the Langley transonic dynamics tunnel with an empennage cantilever-mounted on a sting. The geared-elevator configuration fluttered experimentally at about 20% higher dynamic pressures than the locked-elevator configuration. The experimental flutter dynamic pressure boundaries for both configurations were nearly flat over a Mach number range from 0.9 to 1.1. Flutter calculations (mathematical models) were made for the geared-elevator configuration using three subsonic lifting-surface methods. In one method, the elevator was treated as a discrete surface, and in the other two methods, the stabilizer and elevator were treated as a single warped-surface with the primary difference between these two methods being in the mathematical implementation used. A comparison of the experimental and analytical results shows that the discrete-elevator method predicted best the experimental flutter dynamic pressure level. However, the single warped-surface methods predicts more closely the experimental flutter frequencies and Mach number trends. Author

N76-28159*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC FORCE TESTS OF A SHARP LEADING EDGE

DELTA-WING MODEL AT AMBIENT AND CRYOGENIC TEMPERATURES WITH A DESCRIPTION OF THE APPARATUS EMPLOYED

Robert A. Kilgore and Edwin E. Davenport Jun. 1976 50 p refs

(NASA-TM-X-73901) Avail: NTIS HC $4.00 CSCL 01A

A sharp leading edge delta-wing model was tested through an angle-of-attack range at Mach numbers of 0.75, 0.80, and 0.85 at both ambient and cryogenic temperatures in the Langley 1/3-meter transonic cryogenic tunnel. Total pressure was varied with total temperature in order to hold test Reynolds number constant at a given Mach number. Agreement between the aerodynamic data obtained at ambient and cryogenic temperatures indicates that flows with leading-edge vortex effects are duplicated properly at cryogenic temperatures. The test results demonstrate that accurate aerodynamic data can be obtained by using conventional force-testing techniques if suitable measures are taken to minimize temperature gradients across the balance and to keep the balance at ambient (warm) temperatures during cryogenic operation of the tunnel. Author

N76-28160*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF A 1/6-SCALE MODEL OF THE ROTOR SYSTEMS RESEARCH AIRCRAFT WITH THE ROTORS REMOVED

Raymond E. Mineck, Carl R. Freeman, and James L. Hassell, Jr. Washington NASA Jul. 1976 191 p refs

(NASA-TN-D-8198; L-10435) Avail: NTIS HC $7.50 CSCL 01A

A wind-tunnel investigation was conducted to refine the aerodynamic characteristics of the rotor systems research aircraft. For the investigation, a 1/6-scale model without a main rotor or a tail rotor was used. The model provided the capability for testing different engine nacelle sizes, engine pylon fairings, and tail configurations. The engine thrust effects were modeled by small engine simulators (fans). Data were obtained primarily over an angle-of-attack range from -13 deg to 13 deg at several values of sideslip. Stability characteristics and control effectiveness were investigated. The model with the scaled engine nacelles and the combination T-tail and lower horizontal tail displayed longitudinal and lateral-directional stability. Results show that by reducing the horizontal or vertical-tail span the longitudinal stability is decreased. Reducing the engine nacelle size increases the static stability of the model. Effective dihedral is essentially zero at 0 deg angle of attack and 0 deg wing incidence. Author

N76-28161*# Boeing Commercial Airplane Co., Seattle, Wash.

A COMPUTATIONAL SYSTEM FOR AERODYNAMIC DESIGN AND ANALYSIS OF SUPERSONIC AIRCRAFT. PART 1: GENERAL DESCRIPTION AND THEORETICAL DEVELOPMENT Final Report

W. D. Middleton and J. L. Lundry Washington NASA Jul. 1976 83 p refs Parts 1, 2 and 3 of this series supersede NASA-CR-2520, NASA-CR-2521 and NASA-CR-2522

(Contract NAS1-13732)

(NASA-CR-2715; D6-43798-1-Pt-1) Avail: NTIS HC $5.00 CSCL 01A

An integrated system of computer programs was developed for the design and analysis of supersonic configurations. The system uses linearized theory methods for the calculation of surface pressures and supersonic area rule concepts in combination with linearized theory for calculation of aerodynamic force coefficients. Interactive graphics are optional at the user's request. Schematics of the program structure and the individual overlays and subroutines are described. Author

N76-28162*# Boeing Commercial Airplane Co., Seattle, Wash.

A COMPUTATIONAL SYSTEM FOR AERODYNAMIC DESIGN AND ANALYSIS OF SUPERSONIC AIRCRAFT. PART 3: COMPUTER PROGRAM DESCRIPTION Final Report

W. D. Middleton, J. L. Lundry, and R. G. Coleman Washington NASA Jul. 1976 110 p Parts 1, 2 and 3 of this series supersede NASA-CR-2520, NASA-CR-2521 and NASA-CR-2522

(Contract NAS1-13732)

(NASA-CR-2717; D6-43798-3-Pt-3) Avail: NTIS HC $5.50 CSCL 01A

For abstract, see part 1.

N76-28163*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

VORTEX-LATTICE UTILIZATION

Washington 1976 409 p refs Workshop held at Hampton, Va., 17-18 May 1976

(NASA-SP-405; L-10948) Avail: NTIS HC $11.00 CSCL 01A

The many novel, innovative, and unique implementations and applications of the vortex-lattice method to aerodynamic design and analysis which have been performed by Industry, Government, and Universities were presented. Although this analytical tool is not new, it continues to be utilized and refined in the aeronautical community. For individual titles, see N76-28164 through N76-28186.

N76-28164* Vought Corp., Hampton, Va. Technical Center.

HISTORICAL EVOLUTION OF VORTEX-LATTICE METHODS

John DeYoung *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 1-9 refs (For availability see N76-28163 19-02)

CSCL 01A

A review of the beginning and some orientation of the vortex-lattice method were given. The historical course of this method was followed in conjunction with its field of computational fluid dynamics, spanning the period from L.F. Richardson's paper in 1910 to 1975. The following landmarks were pointed out: numerical analysis of partial differential equations, lifting-line theory, finite-difference method, 1/4-3/4 rule, block relaxation technique, application of electronic computers, and advanced panel methods. Y.J.A.

N76-28165* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUBSONIC FINITE ELEMENTS FOR WING BODY COMBINATIONS

James L. Thomas *In its* Vortex-Lattice Utilization 1976 p 11-26 refs (For availability see N76-28163 19-02)

CSCL 01A

Capabilities, limitations, and applications of various theories for the prediction of wing-body aerodynamics are reviewed. The methods range from approximate planar representations applicable in preliminary design to surface singularity approaches applicable in the later stages of detail design. The available methods for three-dimensional configurations are limited as inviscid solutions with viscous effects included on an empirical or strip basis. Author

N76-28166* Lockheed-California Co., Burbank.

EXTENDED APPLICATIONS OF THE VORTEX LATTICE METHOD

Luis R. Miranda *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 27-47 refs (For availability see N76-28163 19-02)

CSCL 01A

The application of the vortex lattice method to problems not usually dealt with by this technique is considered. It is shown that if the discrete vortex lattice is considered as an approximation to surface-distributed vorticity, then the concept of the generalized principal part of an integral yields a residual term to the vortex-induced velocity that renders the vortex lattice method valid for supersonic flow. Special schemes for simulating non-zero thickness lifting surfaces and fusiform bodies with vortex lattice elements are presented. Thickness effects of wing-like components are simulated by a double vortex lattice layer, and fusiform bodies are represented by a vortex grid arranged on a series of concentric cylindrical surfaces. Numerical considerations peculiar to the application of these techniques are briefly discussed. Author

N76-28167* Lockheed-Georgia Co., Marietta.

NUMERICAL METHOD TO CALCULATE THE INDUCED DRAG OR OPTIMUM LOADING FOR ARBITRARY NON-PLANAR AIRCRAFT

James A. Blackwell, Jr. *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 49-70 refs (For availability

see N76-28163 19-02)
CSCL 01A

A simple unified numerical method applicable to non-planar subsonic aircraft has been developed for calculating either the induced drag for an arbitrary loading or the optimum aircraft loading which results in minimum induced drag. The method utilizes a vortex lattice representation of the aircraft lifting surfaces coupled with the classic equations and theorems for computing and minimizing induced drag. Correlation of results from the numerical method with non-planar solutions obtained from other more complex theories indicates very good agreement. Comparison of the induced-drag computations using the numerical method with experimental data for planar and non-planar configurations was also very good. Author

N76-28168* Boeing Co., Seattle, Wash.
OPTIMIZATION AND DESIGN OF THREE-DIMENSIONAL AERODYNAMIC CONFIGURATIONS OF ARBITRARY SHAPE BY A VORTEX LATTICE METHOD
Winfried M. Feifel *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 71-88 refs (For availability see N76-28163 19-02)
CSCL 01A

A new method based on vortex lattice theory has been developed which can be applied to the combined analysis, induced drag optimization, and aerodynamic design of three-dimensional configurations of arbitrary shape. Geometric and aerodynamic constraints can be imposed on both the optimization and the design process. The method is compared with several known analytical solutions and is applied to several different design and optimization problems, including formation flight and wingtip fins for the Boeing KC-135 tanker airplane. Good agreement has been observed between the theoretical predictions and the wind tunnel test results for the KC-135 modification. Author

N76-28169* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MINIMUM TRIM DRAG DESIGN FOR INTERFERING LIFTING SURFACES USING VORTEX-LATTICE METHODOLOGY
John E. Lamar *In its* Vortex-Lattice Utilization 1976 p 89-111 refs (For availability see N76-28163 19-02)
CSCL 01A

A new method has been developed by which the mean camber surface can be determined for trimmed noncoplanar planforms with minimum vortex drag under subsonic conditions. The method uses a vortex lattice and overcomes previous difficulties with chord loading specification; it uses a Trefftz plane analysis to determine the optimum span loading for minimum drag, then solves for the mean camber surface of the wing which will provide the required loading. Pitching-moment or root-bending-moment constraints can be employed as well at the design lift coefficient. Sensitivity studies of vortex-lattice arrangement have been made with this method and are presented. Comparisons with other theories show generally good agreement. The versatility of the method is demonstrated by applying it to (1) isolated wings, (2) wing-canard configurations, (3) a tandem wing, and (4) a wing-winglet configuration. Author

N76-28170* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATIONS OF VORTEX LATTICE THEORY TO PRELIMINARY AERODYNAMIC DESIGN
John W. Paulson, Jr. *In its* Vortex-Lattice Utilization 1976 p 113-126 refs (For availability see N76-28163 19-02)
CSCL 01A

Some applications of the vortex-lattice theory to the preliminary aerodynamic design and analysis of subsonic aircraft were presented. These methods include the Rockwell-Tulinius vortex-lattice theory for estimating aerodynamic characteristics, a Trefftz plane optimization procedure for determining the span loads for minimum induced drag, and a modification of the Trefftz plane procedure to estimate the induced drag for specified span loads. The first two methods are used to aerodynamically design aircraft planforms, twists, and cambers, and the latter method is used to estimate the drag for components such as flaps and control surfaces. Results from the theories for predicting lift and pitching moment, drag due to lift, and the drag of control surfaces are compared with experimental data. This data was obtained on a general aviation model with flaps and a close-coupled canard-wing model. Author

N76-28171* ARO, Inc., Arnold Air Force Station, Tenn.
UTILIZATION OF THE AEDC THREE-DIMENSIONAL POTENTIAL FLOW COMPUTER PROGRAM
Richard L. Palko *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 127-143 refs Sponsored by AEDC (For availability see N76-28163 19-02)
CSCL 01A

A potential flow computer program which has been in use for several years, was discussed. This program has been used primarily as a tool for flow-field analysis in support of test activities in transonic wind tunnels. Analyses have been made over a Mach number range from 0 to 0.9 for a variety of configurations from aircraft to wind tunnels, with excellent agreement between calculated flow fields and measured wind tunnel data. Analytical and experimental data for seven different flow analysis problems are presented in this paper. Author

N76-28172* ARO, Inc., Arnold Air Force Station, Tenn.
REPORT ON THE STATUS OF A SLOTTED WIND TUNNEL WALL REPRESENTATION USING THE VORTEX-LATTICE TECHNIQUE **c09**
Fred L. Heltsley *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 145-162 refs Sponsored by AEDC (For availability see N76-28163 19-02)
CSCL 01A

A combined analytical/experimental program for development of an improved slotted wind-tunnel wall representation is described. The effort is scheduled for completion in 1977. The vortex-lattice technique which is being used as the primary analytical tool for representing both the wind-tunnel and the lifting model is discussed. Comparisons of results obtained to date with available data are presented. Author

N76-28173* Analytical Methods, Inc., Bellevue, Wash.
A QUADRILATERAL VORTEX METHOD APPLIED TO CONFIGURATIONS WITH HIGH CIRCULATION
Brian Maskew *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 163-186 refs (For availability see N76-28163 19-02)
CSCL 01A

A quadrilateral vortex-lattice method is briefly described for calculating the potential flow aerodynamic characteristics of high-lift configurations. It incorporates an iterative scheme for calculating the deformation of forcefree wakes, including wakes from side edges. The method is applicable to multiple lifting surfaces with part-span flaps deflected, and can include ground effect and wind-tunnel interference. Numerical results, presented for a number of high-lift configurations, demonstrate rapid convergence of the iterative technique. The results are in good agreement with available experimental data. Author

N76-28174* Kansas Univ., Lawrence.
UPPER-SURFACE-BLOWING JET WING INTERACTION
C. Edward Lan *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 187-198 refs (For availability see N76-28163 19-02)
(Grant NsG-1139)
CSCL 01A

A linear, inviscid, subsonic compressible flow theory is formulated for predicting the aerodynamic characteristics of upper-surface-blowing configurations. The effect of the thick jet is represented by a two-vortex-sheet model in order to account for the Mach number nonuniformity. The wing loading with the jet interaction effects is computed by satisfying boundary conditions on the wing and the jet surfaces. The vortex model is discussed in detail. Author

N76-28175* Nielsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF WING-FLAP CONFIGURATIONS WITH EXTERNALLY BLOWN FLAPS
Michael R. Mendenhall *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 199-218 refs (For availability

see N76-28163 19-02)
(Contract NAS1-13158)
CSCL 01A

An analytical method for predicting the longitudinal aerodynamic characteristics of externally blown flap configurations is described. Two potential flow models make up the prediction method: a wing and flap lifting-surface model and a turbofan engine wake model. A vortex-lattice lifting-surface method is used to represent the wing and multiple-slotted trailing-edge flaps. The jet wake is represented by a series of closely spaced vortex rings normal to a centerline which is free to move to conform to the local flow field. The two potential models are combined in an iterative fashion to predict the jet wake interference effects on a typical EBF configuration. Comparisons of measured and predicted span-load distributions, individual surface forces, forces and moments on the complete configuration, and flow fields are included. Author

N76-28176* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME RECENT APPLICATIONS OF THE SUCTION ANALOGY TO ASYMMETRIC FLOW SITUATIONS
James M. Luckring *In its* Vortex-Lattice Utilization 1976 p 219-236 refs (For availability see N76-28163 19-02)
CSCL 01A

A recent extension of the suction analogy for the estimation of vortex loads on asymmetric configurations was reviewed. This includes the asymmetric augmented vortex lift and the forward sweep effect on side edge suction. Application of this extension to a series of skewed wings has resulted in an improved estimating capability for a wide range of asymmetric flow situations. Hence, the suction analogy concept now has more general applicability for subsonic lifting surface analysis. Author

N76-28177* General Dynamics/Fort Worth, Tex.
APPLICATION OF THE VORTEX-LATTICE TECHNIQUE TO THE ANALYSIS OF THIN WINGS WITH VORTEX SEPARATION AND THICK MULTI-ELEMENT WINGS
Charles W. Smith and Ishwar C. Bhateley *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 237-260 refs (For availability see N76-28163 19-02)
CSCL 01A

Two techniques for extending the range of applicability of the basic vortex-lattice method are discussed. The first improves the computation of aerodynamic forces on thin, low-aspect-ratio wings of arbitrary planforms at subsonic Mach numbers by including the effects of leading-edge and tip vortex separation, characteristic of this type wing, through use of the well-known suction-analogy method of E. C. Polhamus. Comparisons with experimental data for a variety of planforms are presented. The second consists of the use of the vortex-lattice method to predict pressure distributions over thick multi-element wings (wings with leading- and trailing-edge devices). A method of laying out the lattice is described which gives accurate pressures on the top and part of the bottom surface of the wing. Limited comparisons between the result predicted by this method, the conventional lattice arrangement method, experimental data, and 2-D potential flow analysis techniques are presented. Author

N76-28178* McDonnell Aircraft Co., St. Louis, Mo.
COMPARISON OF VORTEX LATTICE PREDICTED FORCES WITH WIND TUNNEL EXPERIMENTS FOR THE F-4E(CCV) AIRPLANE WITH A CLOSELY COUPLED CANARD
Lloyd W. Gross *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 261-283 refs (For availability see N76-28163 19-02)
CSCL 01A

The F-4E (CCV) wind tunnel model with closely coupled canard control surfaces was analyzed by means of a version of a vortex lattice program that included the effects of nonlinear leading edge or side edge vortex lift on as many as four individual planforms. The results were compared with experimental data from wind tunnel tests of a 5% scale model tested at a Mach number M = 0.6. They indicated that a nonlinear vortex lift developed on the side edges due to tip vortices, but did not appear to develop on the leading edges within the range of angles of attack that were studied. Instead, substantial leading edge thrust was developed on the lifting surfaces. A configuration buildup illustrated the mutual interference between the wing and control surfaces. On the configuration studied, addition of the wing increased the loading on the canard, but the additional load on the canard due to adding the stabilator was small. Author

N76-28179* Virginia Polytechnic Inst. and State Univ., Blacksburg.
NEW CONVERGENCE CRITERIA FOR THE VORTEX-LATTICE MODELS OF THE LEADING-EDGE SEPARATION
Osama A. Kandil, Dean T. Mook, and Ali H. Nayfeh *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 285-300 refs (For availability see N76-28163 19-02)
(Grant NsG-1262)
CSCL 01A

The convergence criterion for the vortex-lattice technique which deals with delta wings exhibiting significant leading-edge separation was studied. It was shown that one can predict pressure distributions without irregularities which agree fairly well with experimental data (which show some irregularities of their own) by replacing the system of discrete vortex lines with a single concentrated core. This core has a circulation equal to the algebraic sum of the circulations around the discrete lines and is located at the centroid of these lines. Moreover, there is a requirement that the position and strength of the core must converge as the number of elements increases. Because the calculation of the position and strength of the core is much less involved than the calculation of the loads, this approach has the additional desirable feature of requiring less computational time. Author

N76-28180* North Carolina State Univ., Raleigh.
ARRANGEMENT OF VORTEX LATTICES
Fred R. DeJarnette *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 301-323 refs (For availability see N76-28163 19-02)
(Grant DAAG29-76-G-0045)
CSCL 01A

A new method is developed for solving the lifting-surface equation for thin wings. The solution requires the downwash equation to be in the form of Cauchy integrals which can be interpreted as a vortex lattice with the positions of the vortices and control points dictated by the finite sum used to approximate the integrals involved. Lan's continuous loading method is employed for the chordwise integral since it properly accounts for the leading-edge singularity, Cauchy singularity, and Kutta condition. Unlike Lan, the spanwise loading is also continuous and the Cauchy singularity in the spanwise integral is also properly accounted for by using the midpoint trapezoidal rule and the theory of Chebyshev polynomials. This technique yields the exact classical solution to Prandtl's lifting-line equation.The solution to the lifting-surface equation for rectangular wings was found to compare well with other continuous loading methods, but with much smaller computational times, and to converge faster than other vortex lattice methods. Author

N76-28181* Vought Corp., Hampton, Va. Advanced Technology Center.
LATTICE ARRANGEMENTS FOR RAPID CONVERGENCE
Gary R. Hough *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1926 p 325-342 refs (For availability see N76-28163 19-02)
CSCL 01A

A simple, systematic, optimized vortex-lattice approach is developed for application to lifting-surface problems. It affords a significant reduction in computational costs when compared to current methods. Extensive numerical experiments have been carried out on a wide variety of configurations, including wings with camber and single or multiple flaps, as well as high-lift jetflap systems. Rapid convergence as the number of spanwise or chordwise lattices are increased is assured, along with accurate answers. The results from this model should be useful not only in preliminary aircraft design but also, for example, as input for wake vortex roll-up studies and transonic flow calculations. Author

N76-28182* Vought Corp., Hampton, Va.
OPTIMUM LATTICE ARRANGEMENT DEVELOPED FROM A RIGOROUS ANALYTICAL BASIS

John Deyoung *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 343-368 refs (For availability see N76-28163 19-02)
(Contract NAS1-13500)
CSCL 01A

The spanwise vortex-lattice arrangement is mathematically established by lattice solutions of the slender wing which are shown to be analogous to the chordwise vortex-lattice thin wing solution. Solutions for any number N of panels wing theory lift and induced drag and thin wing theory lift and moment are predicted exactly. As N approaches infinity, the slender wing elliptic spanwise loading and thin wing cotangent chordwise loading are predicted, which proves there is mathematical convergence of the vortex-lattice method to the exact answer. Based on this planform spanwise lattice arrangement, an A-vortex-lattice spanwise system is developed for an arbitrary aspect ratio A. This A-lattice has the optimum characteristic of predicting lift accurately for any value of N. Author

N76-28183* Analytical Methods, Inc., Bellevue, Wash.
A SUBVORTEX TECHNIQUE FOR THE CLOSE APPROACH TO A DISCRETIZED VORTEX SHEET
Brian Maskew *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 369-384 refs (For availability see N76-28163 19-02)
CSCL 01A

The close-approach problem associated with vortex-lattice methods was examined numerically with the objective of calculating velocities at arbitrary points, not just at midpoints, between the vortices. The objective was achieved using a subvortex technique in which a vortex splits into an increasing number of subvortices as it is approached. The technique, incorporated in a two-dimensional potential flow method using 'submerged' vortices and sources, was evaluated for a cambered Joukowski airfoil. The method could be extended to three dimensions, and should improve non-linear methods, which calculate interference effects between multiple wings and vortex wakes, and which include procedures for force-free wakes.
Author

N76-28184* Kansas Univ., Lawrence.
SOME APPLICATIONS OF THE QUASI VORTEX-LATTICE METHOD IN STEADY AND UNSTEADY AERODYNAMICS
C. Edward Lan *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 385-406 refs (For availability see N76-28163 19-02)
CSCL 01A

The quasi vortex-lattice method is reviewed and applied to the evaluation of backwash, with applications to ground effect analysis. It is also extended to unsteady aerodynamics, with particular interest in the calculation of unsteady leading-edge suction. Some applications in ornithopter aerodynamics are given. Author

N76-28185* Virginia Polytechnic Inst. and State Univ., Blacksburg.
UNSTEADY FLOW PAST WINGS HAVING SHARP-EDGE SEPARATION
E. H. Atta, O. A. Kandil, D. T. Mook, and A. H. Nayfeh *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 407-421 ref (For availability see N76-28163 19-02)
CSCL 01A

A vortex-lattice technique is developed to model unsteady, incompressible flow past thin wings. This technique predicts the shape of the wake as a function of time; thus, it is not restricted by planform, aspect ratio, or angle of attack as long as vortex bursting does not occur and the flow does not separate from the wing surface. Moreover, the technique can be applied to wings of arbitrary curvature undergoing general motion; thus, it can treat rigid-body motion, arbitrary wing deformation, gusts in the freestream, and periodic motions. Numerical results are presented for low-aspect rectangular wings undergoing a constant-rate, rigid-body rotation about the trailing edge. The results for the unsteady motion are compared with those predicted by assuming quasi-steady motion. The present results exhibit hysteretic behavior. Author

N76-28186* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SAMPLE WINGS FOR STUDY
John E. Lamar *In its* Vortex-Lattice Utilization 1976 p 423-424 refs (For availability see N76-28163 19-02)
CSCL 01A

Two simple wings were selected for study using the various implementations (old and new) of the vortex lattice method. These are: (1) a rectangular wing with an aspect ratio of 2, and (2) a tapered wing with an aspect ratio of 5, a taper ratio of 0.5, a leading sweep of 3.317 deg., and a trailing edge sweep of 1-11.308 deg. This was done in order to gain an appreciation for the accuracy of the various implementations. References were given where force, moment, and pressure data could be found for these wings. Y.J.A.

N76-28187*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL AIRFOIL OPTIMIZATION USING A REDUCED NUMBER OF DESIGN COORDINATES
Garret N. Vanderplaats and Raymond M. Hicks Jul. 1976 21 p refs
(NASA-TM-X-73151; A-6671) Avail: NTIS HC $3.50 CSCL 01A

A method is presented for numerical airfoil optimization whereby a reduced number of design coordinates are used to define the airfoil shape. The approach is to define the airfoil as a linear combination of shapes. These basic shapes may be analytically or numerically defined, allowing the designer to use his insight to propose candidate designs. The design problem becomes one of determining the participation of each such function in defining the optimum airfoil. Examples are presented for two-dimensional airfoil design and are compared with previous results based on a polynomial representation of the airfoil shape. Four existing NACA airfoils are used as basic shapes. Solutions equivalent to previous results are achieved with a factor of more than 3 improvements in efficiency, while superior designs are demonstrated with an efficiency greater than 2 over previous methods. With this shape definition, the optimization process is shown to exploit the simplifying assumptions in the inviscid aerodynamic analysis used here, thus demonstrating the need to use more advanced aerodynamics for airfoil optimization.
Author

N76-28188*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FURTHER WIND TUNNEL MEASUREMENTS OF PRESSURE SIGNATURES FOR A 0.0041-SCALE MODEL OF THE SPACE SHUTTLE ORBITER
Joel P. Mendoza May 1976 137 p ref
(NASA-TM-X-73120; A-6533) Avail: NTIS HC $6.00 CSCL 01A

Pressure signatures for a 0.0041 scale model of the space shuttle orbiter were measured in the wind tunnel at Mach numbers from 1.3 to 4.0. The angles of attack were 0 deg, 10 deg, 20 deg and 30 deg. At each angle of attack the model was rolled from 0 deg to 120 deg in 30 deg increments. Author

N76-28189*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMMENTS ON DIFFERENCE SCHEMES FOR THE THREE-DIMENSIONAL TRANSONIC SMALL-DISTURBANCE EQUATION FOR SWEPT WINGS
Jerry C. South, Jr. Jul. 1976 10 p refs
(NASA-TM-X-71980) Avail: NTIS HC $3.50 CSCL 01A

Certain problems arise in constructing stable finite-difference schemes for the three-dimensional transonic small-disturbance equation with crossflow terms included to better approximate flows over swept wings. These problems are discussed and some possible remedies are offered. Author

N76-28190*# Bell Helicopter Co., Fort Worth, Tex.
WIND TUNNEL TEST RESULTS OF 25 FOOT TILT ROTOR DURING AUTOROTATION Final Report
R. L. Marr 1 Feb. 1976 91 p refs
(Contract NAS2-8580)
(NASA-CR-137824; Rept-301-099-005) Avail: NTIS HC $5.00 CSCL 01A

A 25 foot diameter tilt rotor was tested in the 40 by 80 foot large scale wind tunnel. The test confirmed the predicted autorotation capability of the XV-15 tilt rotor aircraft. Autorotations were made at 60, 80, and 100 knots. A limited evaluation of lateral cyclic was made. Test data indicate a minimum rate of descent of 2,200 feet per minute at 60 knots at the XV-15 design gross weight of 13,000 pounds. Author

N76-28191*# Boston Univ., Mass. Coll. of Engineering.
STATE-SPACE FORMULATIONS FOR FLUTTER ANALYSIS
Steven J. Weiss, Kadin Tseng, and Luigi Morino 30 Jun. 1976 34 p refs
(Grant NGR-22-004-030)
(NASA-CR-148536; SAR-9) Avail: NTIS HC $4.00 CSCL 01A

Various methods are presented and assessed for approximating the aerodynamic forces so that the State Space formulation and off-the-imaginary axis analysis are retained. The advantages of retaining these features are considerable, not only in simplifying the flutter analysis, but especially for more advanced applications such as optimal design of active control in which the flutter is merely a constraint to the optimization problem. Author

N76-28192*# Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF THE POSITION OF MAXIMUM THICKNESS AND OF THE LENGTH OF BODIES OF REVOLUTION ON THE AERODYNAMIC COEFFICIENTS IN SUPERSONIC FLOW
H. Riedel, H. Emunds, and F. J. Niezgodka Washington NASA Jul. 1976 45 p refs Transl. into ENGLISH from Deutsche Luft- und Raumfahrt (West Ger.), research report 70-54, p 1-33
(Contract NASw-2791)
(NASA-TT-F-16735; Rept-70-54) Avail: NTIS HC $4.00 CSCL 01A

The aerodynamic coefficients of bodies of revolution consisting of ogive-cylinder combinations were determined in the 30 x 30 sq cm supersonic wind tunnel by force and pressure measurements for the Mach number range 1.57 to 4.15. A comparison was made of the results with the slender body theory. Author

N76-28193*# Scientific Translation Service, Santa Barbara, Calif.
APPLICATION OF THE MEASUREMENTS OF STATIC AND DYNAMIC AERODYNAMIC COEFFICIENTS FOR THE CALCULATED PREDICTION OF SPIN OBSERVED IN WIND TUNNELS
M. Vanmansart Washington NASA Aug. 1976 18 p Transl. into ENGLISH from the French report Presented at the SMP Specialists Meeting, Brussels, 18-21 Nov. 1975
(Contract NASw-2791)
(NASA-TT-F-17122) Avail: NTIS HC $3.50 CSCL 01A

The computational prediction of actual spin, as an indispensable stage in the validation of a model for spin, is described. Author

N76-28194*# General Dynamics/Fort Worth, Tex.
THE CALCULATION OF STEADY NON-LINEAR TRANSONIC FLOW OVER FINITE WINGS WITH LINEAR THEORY AERODYNAMICS
Atlee M. Cunningham, Jr. Aug. 1976 59 p refs
(Contract NAS1-13855)
(NASA-CR-145023) Avail: NTIS HC $4.50 CSCL 01A

The feasibility of calculating steady mean flow solutions for nonlinear transonic flow over finite wings with a linear theory aerodynamic computer program is studied. The methodology is based on independent solutions for upper and lower surface pressures that are coupled through the external flow fields. Two approaches for coupling the solutions are investigated which include the diaphragm and the edge singularity method. The final method is a combination of both where a line source along the wing leading edge is used to account for blunt nose airfoil effects; and the upper and lower surface flow fields are coupled through a diaphragm in the plane of the wing. An iterative solution is used to arrive at the nonuniform flow solution for both nonlifting and lifting cases. Final results for a swept tapered wing in subcritical flow show that the method converges in three iterations and gives excellent agreement with experiment at alpha = 0 deg and 2 deg. Recommendations are made for development of a procedure for routine application. Author

N76-28195# Royal Aircraft Establishment, Farnborough (England).
MATHEMATICAL APPROACHES TO THE DYNAMICS OF DEFORMABLE AIRCRAFT
1976 125 p refs Supersedes RAE-TM-Struct-807; RAE-TR-71131-RAE-TR-71227
(ARC-R/M-3776-Mono; RAE-TM-Struct-807; RAE-TR-71131; RAE-TR-71227) Avail: NTIS HC $5.50; HMSO £ 7.70

Descriptions of two separate mathematical approaches to the dynamical problems of deformable aircraft are presented. The preface discusses the long-standing need for a philosophy to unify the work of stability and control specialists on the one hand and of flutter and gust response specialists on the other. Taylor attempts to satisfy the need by an extension to the deformable aircraft of concepts developed for the rigid aircraft in classical stability and control theory, whereas Woodcock relies on an extension of ideas from the domain of flutter and gust response. A prolog to Taylor's contribution outlines the historical development of the subject while the main text of each paper is principally concerned with the setting up of the equations of motion and with the associated problems of the choice of frames of reference; the representation of the structural deformation and of the incremental aerodynamics; and the type of generalized coordinates to be employed. For individual titles, see N76-28196 through N76-28197.

N76-28196 Royal Aircraft Establishment, Farnborough (England).
THE MATHEMATICAL FOUNDATION FOR AN INTEGRATED APPROACH TO THE DYNAMICAL PROBLEMS OF DEFORMABLE AIRCRAFT
A. S. Taylor *In its* Math. Approaches to the Dyn. of Deformable Aircraft 1976 p 5-76 refs (For availability see N76-28195 19-02)

Equations of motion of a deformable aircraft in forms consistent with those of the rigid-aircraft equations of classical stability and control theory are developed. The derivation, from the general equations, of separate sets of equations, relating to equilibrium conditions and to perturbations therefrom, is discussed. For the final development of the equations of perturbed (longitudinal) motion in scalar form, a lumped-parameter representation of the aircraft, employing structural and aerodynamic influence coefficients, is assumed, and the formulation is in terms of the natural modes of the elastic airframe. It is shown how, by use of the 'residual flexibility' concept, the large-order system of equations, which results from incorporating all the elastic modes dynamically, can be replaced by a lower-order system, which involves only a few modes directly, but which takes account of the remainder by a modification of derivatives in the retained equations. The mathematical framework is used as the basis for a review of past concepts in the treatment of various aeroelastic problems. The limitations of the mathematical models are discussed and some suggestions are made regarding possible future developments. An outline of the historical development of the subject together with guide lines to the form of mathematical treatment best suited to current problems is given. Certain elements of the established mathematical framework for the investigation of rigid-aircraft dynamics are also presented. Author (ESA)

N76-28197 Royal Aircraft Establishment, Farnborough (England).
THE DYNAMICS OF DEFORMABLE AIRCRAFT
D. L. Woodcock *In its* Math. Approaches to the Dyn. of Deformable Aircraft 1976 p 77-123 refs (For availability see N76-28195 19-02)

The choice of a way of formulating the equations of motion of a deformable aircraft is considered. Emphasis is placed on ease of understanding and application. It is suggested that the use of a frame of reference moving with constant linear and angular velocity will often be the most convenient. In a few cases, in order to obtain a linear problem, a formulation using body axes may be better, and for this purpose body-fixed axes rather than mean-body axes are recommended. The relevant equations of motion are developed in detail. Author (ESA)

N76-28198# Naval Air Engineering Center, Lakehurst, N.J.
AIRCRAFT CARRIER TURBULENCE STUDY FOR PREDICTING AIR FLOW DYNAMICS WITH INCREASING WIND-OVER-DECK VELOCITIES Engineering Dept.
S. Frost 28 Mar. 1968 98 p refs
(AD-A020223; NAEC-ENG-7467) Avail: NTIS CSCL 20/4

An intensive review of literature pertinent to aircraft carrier air flow dynamics and an evaluation of experiments were conducted in order to determine the effects of turbulence on landing aircraft. Particular emphasis was given to the effects on carrier aircraft operations which occur as a result of increasing wind-over-deck (WOD) velocities, as well as carrier dynamics. The effects of WOD velocities and carrier dynamics on air boundary layer were also considered. Recommendations for future, more exacting data acquisition, experiments, and theoretical studies are given. GRA

N76-28199# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF A METHOD FOR COMPUTATION OF SEPARATED, TURBULENT, COMPRESSIBLE BOUNDARY LAYERS Final Report, 2 Jan. 1974 - 28 Feb. 1975
M. C. Altstatt AEDC Feb. 1976 46 p refs
(ARO Proj. P32A-31A; ARO Proj. PF409)
(AD-A021090; ARO-PWT-TR-75-103; AEDC-TR-76-27) Avail: NTIS CSCL 20/4

A computer code for a turbulent, compressible boundary-layer method, capable of carrying out computations in a region of separated flow, is developed and tested. The procedure after separation is to specify either friction velocity or boundary-layer thickness as an independent variable and obtain external velocity as a dependent variable. This requires a trial and error alternation of the specified variable in order to match the desired experimental or computed external velocity. Satisfactory results were obtained by this method in the analysis of certain specialized cases of separated flow. Author (GRA)

N76-28200# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INERTIAL PROPERTIES OF SYMMETRIC SABOT COMPONENTS Final Report
George D. Kahl and David B. Sleator Aug. 1975 25 p ref
(DA Proj. 1W6-62603-AH-78)
(AD-A016112; BRL-1812) Avail: NTIS CSCL 19/1

A simple method is described for experimentally finding the principal moments of inertia and the directions of the principal axes for a rigid body with only one known plane of symmetry in mass distribution. The torsion pendulum method is used, although this method is generally applicable only when a principal axis of the body coincides with the gravity direction. A rapidly converging process is demonstrated for obtaining accurate data, without the above restriction which serves to locate the orientation of all principal axes. The technique was tested against known bodies, and then used to find the inertial properties of a typical sabot component for the XM 735 projectile. GRA

N76-28201# California Inst. of Tech., Pasadena.
FLOW FORCES ON A CYLINDER NEAR A WALL OR NEAR ANOTHER CYLINDER
A. Roshko, A. Steinolfson, and V. Chattoorgoon Jun. 1975 5 p ref Presented at Natl. Conf. on Wind Eng. Res. (2nd) Fort Collins, Colo., 23-25 Jun. 1975
(Contract N00014-67-A-0094-0001)
(AD-A021165) Avail: NTIS CSCL 20/4

Lift, drag and pressure distributions have been measured on cylinders (of various cross-section shapes) near a wall. It is found that as the cylinder approaches the wall its drag decreases and a lift (away from the wall) develops. A similar development occurs for two cylinders approaching each other (in a plane perpendicular to the flow) but in this case there is a range of gap sizes for which the flow is asymmetrical and the forces on the two cylinders are different. The asymmetry is associated with an instability in the near-wake flow, and it can be flipped (switched) by small disturbances. The results are of interest for the effects of wind on cylindrical structures parallel to the ground, for pairs of structures, like stacks, near each other, etc. Author (GRA)

N76-28202# Aeronautical Research Associates of Princeton, Inc., N.J.
AN ANALYTIC AND EXPERIMENTAL INVESTIGATION OF THE WAKES BEHIND FLAPPED AND UNFLAPPED WINGS Final Report
Alan J. Bilanin, Coleman Donaldson, and Richard S. Snedeker Sep. 1974 140 p refs
(Contract F33615-73-C-3138; AF Proj. 1929)
(AD-A021344; AFFDL-TR-74-90) Avail: NTIS CSCL 20/4

An analytic and experimental program was undertaken to define the near wake structure behind flapped and unflapped wings. The vortex wake structure is determined, given the wing lift and drag distributions with models developed in the spirit of Betz. A procedure to estimate the turbulent kinetic energy distribution in the vortex is also given, as well as a method to determine discrete vortex positions in the downstream wake. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N76-28203*# United Technologies Research Center, East Hartford, Conn.
COST/BENEFIT TRADE-OFFS FOR REDUCING THE ENERGY CONSUMPTION OF COMMERCIAL AIR TRANSPORTATION (RECAT) Final Report
F. W. Gobetz and A. P. Dubin Jun. 1976 200 p refs
(Contract NAS2-8608)
(NASA-CR-138877; UTRC-R76-912036-16) Avail: NTIS HC $7.50 CSCL 01C

A study has been performed to evaluate the opportunities for reducing the energy requirements of the U.S. domestic air passenger transport system through improved operational techniques, modified in-service aircraft, derivatives of current production models, or new aircraft using either current or advanced technology. Each of the fuel-conserving alternatives has been investigated individually to test its potential for fuel conservation relative to a hypothetical baseline case in which current, in-production aircraft types are assumed to operate, without modification and with current operational techniques, into the future out to the year 2000. Author

N76-28204*# United Technologies Research Center, East Hartford, Conn.
COST/BENEFIT TRADE-OFFS FOR REDUCING THE ENERGY CONSUMPTION OF COMMERCIAL AIR TRANSPORTATION (RECAT) Summary Report
F. W. Gobetz and A. A. LeShane Jun. 1976 43 p
(Contract NAS2-8608)
(NASA-CR-137878; UTRC-R76-912036-17) Avail: NTIS HC $4.00 CSCL 01C

The RECAT study evaluated the opportunities for reducing the energy requirements of the U.S. domestic air passenger transport system through improved operational techniques, modified in-service aircraft, derivatives of current production models, or new aircraft using either current or advanced technology. Each of these fuel-conserving alternatives was investigated individually to test its potential for fuel conservation relative to a hypothetical baseline case in which current, in-production aircraft types are assumed to operate, without modification and with current operational techniques, into the future out to the year 2000. Consequently, while the RECAT results lend insight into the directions in which technology can best be pursued for improved air transport fuel economy, no single option studied in the RECAT program is indicative of a realistic future scenario. Author

N76-28205# Federal Aviation Agency, Washington, D.C. Office of Systems Engineering Management.
RATIONALE FOR IMPROVING THE PROTECTION AGAINST

MID-AIR COLLISIONS. VOLUME 1: SUMMARY
David R. Israel, Richard F. Bock, John L. Brennan, Thomas M. Johnston, Gordon Jolitz, Keith D. McDonald, Owen E. McIntire, Martin T. Pozesky, and John Reed Dec. 1975 32 p refs
(AD-A023810/5G1; FAA-ED-75-1-Vol-1) Avail: NTIS HC $4.00 CSCL 01/2

The findings, conclusions and recommendations are summarized of a Federal Aviation Administration working group established to consider the pertinent data, analyses, tests, and other factors bearing on possible methods and techniques for preventing midair collisions. Supporting details and information developed by the working group are available in the form of a large number of self-explanatory briefing charts and tables which are contained in another volume. Author

N76-28206*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WAKE VORTEX ENCOUNTER HAZARDS CRITERIA FOR TWO AIRCRAFT CLASSES
Robert I. Sammonds, Glen W. Stinnett, Jr., and William E. Larsen (FAA, Washington, D. C.) Jun. 1976 40 p refs
(NASA-TM-X-73113; FAA-RD-75-206; A-6493) Avail: NTIS HC $4.00 CSCL 01C

An investigation was conducted using a piloted, motion-base simulator to determine wake vortex hazard criteria for two classes of jet transport aircraft. A light business jet and a large multiengine jet transport were represented respectively. The hazard boundaries were determined in terms of the maximum bank angle due to the vortex encounter. Upsets as small as 7 deg in bank angle were considered to be hazardous at breakout altitude (200 ft (61.0 m)) for Instrument Flight Rule (IFR) and at 50 ft (15.2 m) for Visual Flight Rule (VFR) for both aircraft classes. Proximity to the ground was the primary reason for a hazardous rating. This was reflected in the reduction in the maximum bank angle at the hazard boundary and in more consistent ratings as altitude was decreased. Author

N76-28207*# Kanner (Leo) Associates, Redwood City, Calif.
ERGONOMIC ASPECTS OF AIR ACCIDENTS DURING AGRICULTURAL SERVICE
S. Kwiatkowski Washington NASA Aug. 1976 9 p Transl. into ENGLISH of conf. paper from the Institut Lotnictwa, Warsaw Presented at the 1st Nat. Scientific-Technological Conf., 17-19 Mar. 1975, proceedings p 283-289
(Contract NASw-2790)
(NASA-TT-F-17146) Avail: NTIS HC $3.50 CSCL 01C

The chief shortcomings in the elements of agricultural aircraft are discussed along with the main causes of air accidents occurring during agricultural service based on some statistics on the frequency of the various causes. Some of these causes were found to be collisions with electric power lines, collisions with objects in the chemical loading area, hitting the ground during large turns, emergency landings due to lack of fuel, engine failure, and landing. The special problems of the pilot being adversely influenced by chemicals and noise are discussed, and the lack of satisfactory solutions is noted. Author

N76-28208# Civil Aeronautics Board, Washington, D.C. Statistical Data Div.
HANDBOOK OF AIRLINE STATISTICS, 1975 SUPPLEMENT Final Report
Jerold Coffee Nov. 1975 223 p
(PB-250519/6; CAB-BAS-75-01-Suppl) HC $7.75 CSCL 01B

An updated reference volume of some 216 pages includes a wide variety of annual traffic, profit and loss and balance sheet data for each United States Certificated Air Carrier for 1973 and 1974. Other sections include chronologies of significant events affecting aviation -- in general, growth of the airline industry, significant legislation and decisions and technological advances as well as carrier group data for calendar 1973 and 1974. For the first time, certain rather limited information involving classes of air carriers other than Certificated Air Carriers has been included. Author

N76-28209# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, U.S. AIR CARRIER OPERATIONS 1974
30 Dec. 1975 97 p
(PB-250813/3; NTSB-ARC-76-1) Avail: NTIS HC $5.00 CSCL 01B

The publication presents the record of aviation accidents which occurred in all operations of the U.S. air carriers for calendar year 1974. It includes analyses by classes of carriers, causes and related factors, types of accidents, and phases of operations. Statistical tables, which summarize the accidents, fatalities, and accident rates; causal tables; and briefs of accidents are presented. GRA

N76-28210# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING ALCOHOL AS A CAUSE/FACTOR, US GENERAL AVIATION 1974
15 Dec. 1975 44 p
(PB-250515/4; NTSB-AMM-75-17) Avail: NTIS HC $4.00 CSCL 01B

Reports are presented on all U.S. general aviation accidents, occurring in 1974, involving alcohol impairment as a cause/factor. Included are 50 accident briefs, 46 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-28211 California Univ., Berkeley.
EFFECT OF MULTIPLE PATH APPROACH PROCEDURES ON RUNWAY LANDING CAPACITY Ph.D. Thesis
Vojin Stanimir Tosic 1975 255 p
Avail: Univ. Microfilms Order No. 76-15397

A model is developed which is capable of computing the expected ultimate landing runway capacity, under ILS and MLS conditions, when aircraft population characteristics and air traffic control separation rules are given. This model can be applied in situations when only a horizontal separation between aircraft approaching a runway is allowed, as well as when both vertical and horizontal separations are possible. Results suggest that an increase in runway landing capacity, caused by introducing the MLS described multiple approach paths, is to be expected only when an aircraft population consists of aircraft with significantly differing approach velocities and particularly in situations when a vertical separation can be applied. Dissert. Abstr.

N76-28212*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF TWO COMMERCIAL AND THE TERMINAL CONFIGURED VEHICLE AREA NAVIGATION SYSTEMS
Charles E. Knox and Desmond Hartnell (Boeing Commercial Airplane Co.) 17 Jun. 1976 29 p refs
(NASA-TM-X-72683) Avail: NTIS HC $4.00 CSCL 17G

A comparison was made of some of the more important features of two commercially available area navigation systems and the Terminal Configured Vehicle (TCV) area navigation system. Topics discussed included system design criteria, system elements, calculation of the navigation solution, and presentation of guidance information. Author

N76-28213*# Wolf Research and Development Corp., Riverdale, Md.
MANSEE DATA ANALYSIS RESULTS
William Hatch and Bruce Gibbs Jul. 1975 89 p refs
(Contract NAS6-2173)

(NASA-CR-141409; Rept-006-75) Avail: NTIS HC $5.00 CSCL 17G

Results of the data reduction and analysis for the Marine Navigation Systems Evaluation Experiment (MANSEE) are presented. Topics discussed include: the MANSEE test; the navigation sensors which were exercised; the ground truth instrumentation and the processing of ground truth data; and the residual statistics for individual navigation sensors. Residuals were calculated by differencing the actual measurements with anticipated measurements computed from the ground truth trajectory. The results obtained by using the SEAMAP program to filter data from the navigation sensors are also presented. The resultant filtered trajectories were differenced with the corresponding ground truth trajectories to obtain navigation position and velocity errors. Author

N76-28214# Lincoln Lab., Mass. Inst. of Tech., Lexington.
IPC DESIGN VALIDATION AND FLIGHT TESTING, INTERIM RESULTS Interim Test Report, Feb.-Oct. 1975
J. W. Andrews 16 Mar. 1976 107 p refs
(Contracts DOT-FA72-WAI-261; F19628-76-C-0002)
(AD-A024935/9; ATC-57; FAA-RD-76-22) Avail: NTIS HC $5.50 CSCL 01/2

Intermittent Positive Control, an automated aircraft collision avoidance system requiring the participation of the aircraft pilots involved, was evaluated in a series of live flight tests. Results of those tests are summarized. Results are given for IPC algorithm design evaluation flights and pilot interaction evaluation flights. Author

N76-28215# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MULTIPATH PARAMETER COMPUTATIONS FOR THE MLS SIMULATION COMPUTER PROGRAM
Jack Capon 8 Apr. 1976 195 p refs
(Contracts DOT-FA74WAI-461; F19628-76-C-0002)
(AD-A024350/1; ATC-68; FAA-RD-76-55) Avail: NTIS HC $7.50 CSCL 01/3

A set of mathematical models and computer programs were developed to characterize multipath propagation in an airport environment. When combined with system mathematical models, these models are intended to provide a firm technical basis for assessing the performance of candidate Microwave Landing Systems (MLS) in realistic airport environments. The two paramount issues in developing these models have been (1) validation based on actual field test data and (2) computer running time. The obstacles modeled include buildings and aircraft, as well as the ground which can cause both specular reflections and diffuse scattering. In addition, the shadowing effects due to runway humps, aircraft, and buildings approaching the line of sight between transmitter and receiver are included. Computational procedures are presented for obtaining the salient multipath parameters, i.e., relative magnitude, phase, directional angles, Doppler frequency, and time delay. Computer programs were written for these algorithms using the FORTRAN programming language, with structured programming methods, such as Iftran, employed whenever possible. A presentation is given of computer validation data for the computational procedures. A comparison of these computer validation results with experimental field data demonstrates good agreement in all cases of interest. Author

N76-28216# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DABS MODULATION AND CODING DESIGN, A SUMMARY
T. J. Goblick 12 Mar. 1976 105 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A024471/5; ATC-52; FAA-RD-75-93) Avail: NTIS HC $5.50 CSCL 17/7

The Discrete Address Beacon System (DABS) designed as an evolutionary replacement for the Air Traffic Control Radar Beacon System (ATCRBS) is described. As with ATCRBS, DABS is a cooperative Air Traffic Surveillance System utilizing ground based sensors (interrogators) and airborne transponders. In addition to its surveillance function, DABS integrally accommodates ground-to-air and air-to-ground data link communication within the interrogations and replies. In DABS, each aircraft transponder may be individually interrogated, using its unique 24-bit address, giving the ground based interrogators freedom to schedule interrogations and replies to make efficient use of the channels essentially independent of the aircraft traffic distribution. This report presents the rationale for the selection of the DABS signalling waveforms and error control techniques is presented. The main issues in arriving at the final link design were (1) affordable transponder cost, (2) electromagnetic compatibility with ATCRBS and TACAN, and (3) adequate performance in the channel environment, which includes interference from ATCRBS transmissions. The resulting DABS link design uses the ATCRBS frequencies, achieves surveillance reliability and accuracy superior to that of ATCRBS, and transmits ground-to-air data link messages with high reliability. This is accomplished without noticeably affecting ATCRBS performance, with less channel occupancy per target report than ATCRBS, and with transponders projected to cost approximately 160% of the cost of ATCRBS transponders. Author

N76-28217# Texas Univ., Austin. Applied Research Labs.
LOW FREQUENCY PORTABLE BEACON OPERATING INSTRUCTIONS
Dennis W. Feller 6 Jan. 1976 29 p
(Contract N60921-74-C-0217)
(AD-A020845; ARL-TM-76-1) Avail: NTIS CSCL 17/7

This report contains the operating instructions and circuit diagrams for the low frequency portable beacons being added to the Navigation, Tracking, and Communications (NTC) acoustic navigation subsystem at Fort Lauderdale, Florida. While designed for use at the Naval Surface Weapons Center Test Facility, the portable beacons combined with the Applied Research Laboratories' (ARL) range readers constitute a totally portable navigation system that could be used wherever water depths are not greater than 2,000 ft. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-28218 Georgia Inst. of Tech., Atlanta.
MINIMUM WEIGHT DESIGN OF FUSELAGE TYPE STIFFENED CIRCULAR CYLINDRICAL SHELLS SUBJECTED TO PURE TORSION AND COMBINED TORSION WITH AXIAL COMPRESSION WITH AND WITHOUT LATERAL PRESSURE Ph.D. Thesis
Jagannath Giri 1976 164 p
Avail: Univ. Microfilms Order No. 76-16281

A procedure including a highly automated computer program for the minimum weight design of fuselage type stiffened circular cylindrical shells subjected to torsion and to torsion combined with axial compression with and without lateral pressure is developed. For an internally stiffened fuselage type thin circular cylindrical shell of specified material, radius and length, the size, shape, spacings of stiffeners and the skin thickness are found in order that it can safely carry a prescribed pure torsion or combined torsion with axial compression with and without lateral pressure with minimum weight. The procedure is demonstrated through a number of selected practical design problems. Dissert. Abstr.

N76-28219*# Lockheed-California Co., Burbank.
ARROW-WING SUPERSONIC CRUISE AIRCRAFT STRUCTURAL DESIGN CONCEPTS EVALUATION. VOLUME 1: SECTIONS 1 THROUGH 6
I. F. Sakata and G. W. Davis [1975] 436 p refs
(Contract NAS1-12288)
(NASA-CR-132575-1) Avail: NTIS HC $11.75 CSCL 01C

The structural approach best suited for the design of a Mach 2.7 arrow-wing supersonic cruise aircraft was investigated. Results, procedures, and principal justification of results are presented. Detailed substantiation data are given. In general, each major analysis is presented sequentially in separate sections to provide continuity in the flow of the design concepts analysis effort. In addition to the design concepts evaluation and the detailed engineering design analyses, supporting tasks encompassing: (1) the controls system development; (2) the propulsion-

airframe integration study; and (3) the advanced technology assessment are presented. Author

N76-28220*# Lockheed-California Co., Burbank.
ARROW-WING SUPERSONIC CRUISE AIRCRAFT STRUCTURAL DESIGN CONCEPTS EVALUATION. VOLUME 2: SECTIONS 7 THROUGH 11
I. F. Sakata and G. W. Davis [1975] 409 p refs
(Contract NAS1-12288)
(NASA-CR-132575-2) Avail: NTIS HC $11.00 CSCL 01C

The materials and advanced producibility methods that offer potential structural mass savings in the design of the primary structure for a supersonic cruise aircraft are identified and reported. A summary of the materials and fabrication techniques selected for this analytical effort is presented. Both metallic and composite material systems were selected for application to a near-term start-of-design technology aircraft. Selective reinforcement of the basic metallic structure was considered as the appropriate level of composite application for the near-term design. Author

N76-28221*# Lockheed-California Co., Burbank.
ARROW-WING SUPERSONIC CRUISE AIRCRAFT STRUCTURAL DESIGN CONCEPTS EVALUATION. VOLUME 3: SECTIONS 12 THROUGH 14
I. F. Sakata and G. W. Davis [1975] 330 p refs
(Contract NAS1-12288)
(NASA-CR-132575-3) Avail: NTIS HC $10.00 CSCL 01C

The design of an economically viable supersonic cruise aircraft requires the lowest attainable structural-mass fraction commensurate with the selected near-term structural material technology. To achieve this goal of minimum structural-mass fraction, various combinations of promising wing and fuselage primary structure were analyzed for the load-temperature environment applicable to the arrow wing configuration. This analysis was conducted in accordance with the design criteria specified and included extensive use of computer-aided analytical methods to screen the candidate concepts and select the most promising concepts for the in-depth structural analysis. Author

N76-28222*# Lockheed-California Co., Burbank.
ARROW-WING SUPERSONIC CRUISE AIRCRAFT STRUCTURAL DESIGN CONCEPTS EVALUATION. VOLUME 4: SECTIONS 15 THROUGH 21
I. F. Sakata and G. W. Davis [1975] 430 p refs
(Contract NAS1-12288)
(NASA-CR-132575-4) Avail: NTIS HC $11.75 CSCL 01C

The analyses performed to provide structural mass estimates for the arrow wing supersonic cruise aircraft are presented. To realize the full potential for structural mass reduction, a spectrum of approaches for the wing and fuselage primary structure design were investigated. The objective was: (1) to assess the relative merits of various structural arrangements, concepts, and materials; (2) to select the structural approach best suited for the Mach 2.7 environment; and (3) to provide construction details and structural mass estimates based on in-depth structural design studies. Production costs, propulsion-airframe integration, and advanced technology assessment are included. Author

N76-28223*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IRRADIATE-ANNEAL SCREENING OF TOTAL DOSE EFFECTS IN SEMICONDUCTOR DEVICES
Alan G. Stanley and William E. Price 15 Jul. 1976 38 p refs
(Contract NAS7-100)
(NASA-CR-148487; JPL-TM-33-788) Avail: NTIS HC $4.00 CSCL 22B

An extensive investigation of irradiate-anneal (IRAN) screening against total dose radiation effects was carried out as part of a program to harden the Mariner Jupiter/Saturn 1977 (MJS'77) spacecraft to survive the Jupiter radiation belts. The method consists of irradiating semiconductor devices with Cobalt-60 to a suitable total dose under representative bias conditions and of separating the parts in the undesired tail of the distribution from the bulk of the parts by means of a predetermined acceptance limit. The acceptable devices are then restored close to their preirradiation condition by annealing them at an elevated temperature. IRAN was used when lot screen methods were impracticable due to lack of time, and when members of a lot showed a diversity of radiation response. The feasibility of the technique was determined by testing of a number of types of linear bipolar integrated circuits, analog switches, n-channel JFETS and bipolar transistors. Based on the results of these experiments a number of device types were selected for IRAN of flight parts in the MJS'77 spacecraft systems. The part types, screening doses, acceptance criteria, number of parts tested and rejected as well as the program steps are detailed. Author

N76-28224*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDY OF OPERATIONAL PARAMETERS IMPACTING HELICOPTER FUEL CONSUMPTION
Jeffrey L. Cross and Dariene D. Stevens Jul. 1976 42 p refs
(NASA-TM-X-73922) Avail: NTIS HC $4.00 CSCL 01C

A computerized study of operational parameters affecting helicopter fuel consumption was conducted as an integral part of the NASA Civil Helicopter Technology Program. The study utilized the Helicopter Sizing and Performance Computer Program (HESCOMP) developed by the Boeing-Vertol Company and NASA Ames Research Center. An introduction to HESCOMP is incorporated in this report. The results presented were calculated using the NASA CH-53 civil helicopter research aircraft specifications. Plots from which optimum flight conditions for minimum fuel use that can be obtained are presented for this aircraft. The results of the study are considered to be generally indicative of trends for all helicopters. Author

N76-28225*# McDonnell-Douglas Corp., Long Beach, Calif.
TECHNICAL AND ECONOMIC ASSESSMENT OF SPAN-LOADED CARGO AIRCRAFT CONCEPTS
Jan. 1976 142 p
(Contract NAS1-13964)
(NASA-CR-144962) Avail: NTIS HC $6.00 CSCL 01C

The benefits are assessed of span distributed loading concepts as applied to future commercial air cargo operations. A two phased program is used to perform this assessment. The first phase consists of selected parametric studies to define significant configuration, performance, and economic trends. The second phase consists of more detailed engineering design, analysis, and economic evaluations to define the technical and economic feasibility of a selected spanloader design. A conventional all-cargo aircraft of comparable technology and size is used as a comparator system. The technical feasibility is demonstrated of the spanloader concept with no new major technology efforts required to implement the system. However, certain high pay-off technologies such as winglets, airfoil design, and advanced structural materials and manufacturing techniques need refinement and definition prior to application. In addition, further structural design analysis could establish the techniques and criteria necessary to fully capitalize upon the high degree of structural commonality and simplicity inherent in the spanloader concept. Author

N76-28226*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
THE LONGITUDINAL EQUATIONS OF MOTION OF A TILT PROP/ROTOR AIRCRAFT INCLUDING THE EFFECTS OF WING AND PROP/ROTOR BLADE FLEXIBILITY
H. C. Curtiss, Jr. Apr. 1976 63 p
(Grant NsG-2045)
(NASA-CR-137855; TR-1273) Avail: NTIS HC $4.50 CSCL 01C

The equations of motion for the longitudinal dynamics of a tilting prop/rotor aircraft are developed. The analysis represents an extension of the equations of motion. The effects of the longitudinal degrees of freedom of the body (pitch, heave and horizontal velocity) are included. The results of body freedom can be added to the equations of motion for the flexible wing propeller combination. Author

N76-28227*# Lockheed-Georgia Co., Marietta.
GROUND SIMULATION AND TUNNEL BLOCKAGE FOR A JET-FLAPPED, BASIC STOL MODEL TESTED TO VERY HIGH LIFT COEFFICIENTS
J. E. Hackett, R. A. Boles, and D. E. Lilley Mar. 1976 133 p refs

(Contract NAS2-8745)
(NASA-CR-137857) Avail: NTIS HC $6.00 CSCL 01C

Ground effects experiments and large/small-tunnel interference studies were carried out on a model with a 20-inch (50.8 cm) span wing. The wing, which includes a highly deflected knee-blown flap can be fitted with unflapped tips and slats. A low-mounted tailplane can be fitted to the aft fuselage. Three-component balance meaurements, made with a fixed ground equipped with a single boundary-layer blowing slot, were compared with datum, moving-ground results. Good comparisons were obtained up to model blowing momentum coefficients of approximately two, after which the particular floor blowing settings used proved insufficient to prevent floor separation in the vicinity of the model. Skin friction measurements, taken routinely along the floor centerline, proved invaluable during the analysis of results, and their use is recommended as input to determination of floor BLC setting. A careful investigation was made of pitching moments, including tail-on, close-to-ground cases, with favorable results. Drag proved the most sensitive to the change from a moving to the boundary-layer controlled ground. Author

N76-28228*# Kanner (Leo) Associates, Redwood City, Calif.
LABORATORY FLIGHT SIMULATION WITH FREE-FLIGHT MODELS
Jean Gobeltz Washington NASA Aug. 1976 35 p refs Transl. into ENGLISH of conf. paper from Inst. de Mecan. des Fluides de Lille Presented at the SMP Specialists Meeting: Stall-Spin Probl. of Mil. Aircraft, Brussels, 18-21 Nov. 1975 p 15-1 - 15-16
(Contract NASw-2790)
(NASA-TT-F-17124) Avail: NTIS HC $4.00 CSCL 01C

Free-flight models used in laboratory experimentation are discussed. Two operating procedures are defined: direct similitude testing, where tests are intended to predict directly the results of flight tests on the full-scale aerodyne, and indirect similitude testing, where tests are used first for analysis of the phenomena, and second for its modelling subsequently applied to the aerodyne itself. Dynamic stall and spin results are given as examples of direct similitude testing. Use of indirect similitude is shown to be a broader and more scientifically fertile testing procedure. Examples quoted are relative to longitudinal dynamic behavior and vertical atmospheric gust response of aircraft. It is shown how, for phenomena modelling, both stationary aerodynamic characteristics and aerodynamic derivative data of the model are extracted from purposely designed flights. These data are then used for computation. Piloting methods of the models are given. With preceding results as examples, other types of tests relative to landing or cross-wind landing, ditching, transverse gusts, and active controls are only mentioned. Author

N76-28229*# Scientific Translation Service, Santa Barbara, Calif.
THE EFFECT OF ROCKETS AND DISSYMMETRIC LOADS ON THE SPIN, BY STATIC MOMENTS
J. Gobeltz and L. Beaurain Washington NASA Aug. 1976 31 p Transl. into ENGLISH from the French report Presented at the SMP Specialists Meeting, Brussels, 18-21 Nov. 1975
(Contract NASw-2791)
(NASA-TT-F-17125) Avail: NTIS HC $4.00 CSCL 01C

The results of studies of a general character that were carried out on several models in a spin wind tunnel are presented. The first topic taken up concerns the effect of rockets used as a rescue device from a spin; the study has been limited to light planes; however, certain conclusions could be valid, at least qualitatively, for other types of airplanes, military ones in particular. The second topic concerns the effect of an dissymmetric load on the spin of airplanes of all types: military, light or transport. The dissymmetry considered is a purely mass-related one such as could be due to fuel airfoil. Meanwhile, for military planes, the dissymmetry caused this time by external loads (whose dissymmetry is both weight and geometry related), is also taken into consideration. Author

N76-28230# Battelle Columbus Labs., Ohio.
HIGH-PERFORMANCE VANE PUMP FOR AIRCRAFT HYDRAULIC SYSTEMS Final Report, 20 Mar. 1972 - 18 Oct. 1975
David L. Thomas Dec. 1975 106 p
(Contract F33615-72-C-1673; AF Proj. 3145)
(AD-A020022; AFAPL-TR-75-94) Avail: NTIS CSCL 13/11

The purpose of this hydraulic-pump technology-development project was to investigate the feasibility and applicability and to demonstrate the capability of new vane-pump concepts to meet future aircraft hydraulic-system requirements. The specific objective was the development of a pressure-compensated hydraulic pump to deliver 45 gpm at 4,000 psi while operating at 30,000 rpm with MIL-H-5606B hydraulic fluid. The new pump concepts were the product of previous Air Force programs and included a pivoting-tip vane for hydrodynamic load support and a two-lobed deformable cam ring for variable displacement. During this program both component experiments and pump evaluations were performed. GRA

N76-28231# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
ENVIROMENTAL STUDY OF EXTERNAL AIRCRAFT FUEL TANKS STORED IN RIGID POLYURETHANE FOAM
John A. Hincks Dec. 1975 22 p
(AD-A021200; DSPS-75-74) Avail: NTIS CSCL 13/4

External aircraft fuel tanks were foamed-in-place by Sacramento ALC for the purpose of testing totally encapsulated items. Four tanks were received by the Air Force Packaging Evaluation Agency (AFPEA) and subjected to the aggressive saline atmosphere and severe weathering environment at an Eglin AFB test station located on the Gulf of Mexico. Although the tanks had been transported and stored outside in open wooden crates, and more recently in improved galvanized slotted angle steel framework, for extended periods of time, approximately 20% of the assembled tanks were corroding, leaving much room for improvement. This study indicated that the method of encapsulating the items in polyurethane foam is not only more cost effective but shows marked improvement in corrosion resistance and affords physical protection as well. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-28232*# Washington Univ., Seattle.
WIND SHEAR DETECTION USING MEASUREMENT OF AIRCRAFT TOTAL ENERGY CHANGE
Robert G. Joppa May 1976 13 p ref
(Grant NCA2-OP850-601)
(NASA-CR 137839) Avail: NTIS HC $3.50 CSCL 01D

Encounters with wind shears are of concern and have caused major accidents, particularly during landing approaches. Changes in the longitudinal component of the wind affect the aircraft by changing its kinetic energy with respect to the air. It is shown that an instrument which will measure and display the rate of change of total energy of the aircraft with respect to the air will give a leading indication of wind shear problems. The concept is outlined and some instrumentation and display considerations are discussed. Author

N76-28233*# Stanford Univ., Calif.
TRANSCRIPTION OF THE WORKSHOP ON GENERAL AVIATION ADVANCED AVIONICS SYSTEMS
Michael Tashker, ed. 1975 167 p Workshop held at Stanford, Calif., 5-6 Nov. 1975
(Contract NAS2-9023)
(NASA-CR-137861) Avail: NTIS HC $6.75 CSCL 01D

Papers are presented dealing with the design of reliable, low cost, advanced avionics systems applicable to general aviation in the 1980's and beyond. Sensors, displays, integrated circuits, microprocessors, and minicomputers are among the topics discussed. J.M.S.

N76-28234# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
FEASIBILITY OF USING ELECTRONIC QUENCHING TO ELIMINATE HALOGEN GAS IN GEIGER-MULLER DETECTORS IN AIRCRAFT OIL GAUGING SYSTEMS

M.S. Thesis
Jerry L. McClellan Dec. 1975 98 p refs
(AD-A020999; GNE/PH/75-19) Avail: NTIS CSCL 18/4

The feasibility of electronic quenching was studied for Geiger-Muller (GM) radiation detectors used in aircraft oil gauging systems. A solid-state, variable-parameter quenching circuit was used which employed a multivibrator and a high-voltage transistor to reduce the applied voltage on the detector. The GM detectors which were tested included halogen-quenched counters formerly used in aircraft oil systems, as well as locally manufactured GM tubes filled to 100-200 torr of combinations of Ar, CO sub 2, H sub 2, N sub 2, and Ne. Experiments with operational halogen-quenched tubes indicated that with electronic quenching, an increased voltage operating range and tube counting lifetime are possible. The results for inoperable halogen-quenched detectors and for detectors containing no quenching gas were mostly inconclusive. GRA

N76-28235# Federal Aviation Administration, Washington, D.C.
INTEGRATED NATIONAL AIRSPACE COMMUNICATION SYSTEM (INACS) FOR THE SUPPORT OF AIR TRAFFIC CONTROL OPERATIONS IN THE 1980S AND 1990S. OPERATIONAL MAINTENANCE REQUIREMENTS
11 Jul. 1975 132 p
(AD-A018561; FAA-INACS-011-221-OR) Avail: NTIS CSCL 01/3

This document is intended to provide the operating/maintenance requirements for future National Airspace System communications system designs and developmental efforts, and the vehicle for discussion and coordination with the various policy planning, operating, maintenance, and engineering activities concerned with FAA Communications. Requirements submitted by Air Traffic and Airway Facilities Services have been used and augmented by inputs from SRDS, MITRE and the Computer Sciences Corporation. Communications requirements are established for all national airspace environments. This document provides the basic sets of requirements applicable to each of the environments and their subsets, i.e., voice/data air/ground communications, voice ground/ground communications and data ground/ground communications. These requirements will be utilized to derive the detailed functional and design requisites to be incorporated in all Integrated National Airspace Communication System (INACS) specifications. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-28236*# Kanner (Leo) Associates, Redwood City, Calif.
CERTAIN CONCLUSIONS ON THE SUPERSONIC TRANSPORT AIRCRAFT BOOM
J. C. Wanner Washington NASA Aug. 1976 16 p Transl. into ENGLISH of "Quelques Conclusions sur le Bang des Avions de Transport Supersoniques" (report) Chatillon, France, ONERA, Direction Technique, 29 Apr. 1976 12 p
(Contract NASw-2790)
(NASA-TT-F-17149) Avail: NTIS HC $3.50 CSCL 20A

Certain conclusions are reached regarding the flight of supersonic transport aircraft. The bearable limit of the boom is situated below 0.8 millibar. The mechanical effects on structures and physiological effects on humans and animals are negligible, but for sociophysiological reasons supersonic flight over inhabited areas should be banned, and steps must be taken to determine that the focalization point is situated in uninhabited areas.
Author

N76-28237*# Detroit Diesel Allison, Indianapolis, Ind. Dept. of Combustion Research and Development.
POLLUTION REDUCTION TECHNOLOGY PROGRAM, TURBOPROP ENGINES, PHASE 1
R. D. Anderson, A. S. Herman, J. G. Tomlinson, J. M. Vaught, and A. J. Verdouw Mar. 1976 134 p refs
(Contract NAS3-18561)
(NASA-CR-135040; EDR-8708) Avail: NTIS HC $6.00 CSCL 21E

Exhaust pollutant emissions were measured from a 501-D22A turboprop engine combustor and three low emission combustor types -- reverse flow, prechamber, and staged fuel, operating over a fuel-air ratio range of .0096 to .020. The EPAP LTO cycle data were obtained for a total of nineteen configurations. Hydrocarbon emissions were reduced from 15.0 to .3 lb/1000 Hp-Hr/cycle, CO from 31.5 to 4.6 lb/1000 Hp-Hr/cycle with an increase in NOx of 17 percent, which is still 25% below the program goal. The smoke number was reduced from 59 to 17. Emissions given here are for the reverse flow Mod. IV combustor which is the best candidate for further development into eventual use with the 501-D22A turboprop engine. Even lower emissions were obtained with the advanced technology combustors.Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-28238*# Rensselaer Polytechnic Inst., Troy, N.Y. Electrical and Systems Engineering Dept.
REDUCED STATE FEEDBACK GAIN COMPUTATION Final Report, 1 Jun. 1975 - 30 Nov. 1976
Howard Kaufman 30 Nov. 1976 41 p refs
(Grant NsG-1188)
(NASA-CR-148491) Avail: NTIS HC $4.00 CSCL 01C

Because application of conventional optimal linear regulator theory to flight controller design requires the capability of measuring and/or estimating the entire state vector, it is of interest to consider procedures for computing controls which are restricted to be linear feedback functions of a lower dimensional output vector and which take into account the presence of measurement noise and process uncertainty. Therefore, a stochastic linear model that was developed is presented which accounts for aircraft parameter and initial uncertainty, measurement noise, turbulence, pilot command and a restricted number of measurable outputs. Optimization with respect to the corresponding output feedback gains was performed for both finite and infinite time performance indices without gradient computation by using Zangwill's modification of a procedure originally proposed by Powell. Results using a seventh order process show the proposed procedures to be very effective.
Author

N76-28239*# Virginia Military Inst., Lexington.
A VELOCITY-COMMAND CONTROLLER FOR A VTOL AIRCRAFT
Gerald F. Reid 1976 5 p refs
(Grant NGR-47-018-005)
(NASA-CR-148535; APPL-5-2) Avail: NTIS HC $3.50 CSCL 01C

A technique is presented for calculating feedback and feedforward gain matrices that enable a VTOL aircraft to track input commands of forward and vertical velocity while maintaining acceptable responses to pilot inputs. Leverrier's algorithm is used for determining a set of state-variable, feedback gains that force the closed-loop poles and zeros of one pilot-input transfer function to pre-selected positions in the s-plane. This set of feedback gains is then used to calculate the feedback and feedforward gains for the velocity-command controller. The method is computationally attractive since the gains are determined by solving systems of linear, simultaneous equations. The method is used in a digital simulation of the CH-47 helicopter to control longitudinal dynamics. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-28240*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ACCEPTANCE TEST PROCEDURE FOR SHUTTLE ACTUATORS SIMULATOR (ELEVON SUBSYSTEM)
Julian Barr Apr. 1976 224 p
(Contract NAS9-12200)
(NASA-CR-147830; LES-8124; JSC-11095) Avail: NTIS HC $7.75 CSCL 14B

The acceptance test procedure is described for the Lockheed Electronics Elevon Servoactuator Simulator to be used in the Shuttle Avionics Integration Laboratory (SAIL). The intent of this acceptance test procedure is to comply with the technical Shuttle Actuators Simulator Requirements. Acceptance tests will be performed on each Elevon Servoactuator Simulator. Author

N76-28172* ARO, Inc., Arnold Air Force Station, Tenn.
REPORT ON THE STATUS OF A SLOTTED WIND TUNNEL WALL REPRESENTATION USING THE VORTEX-LATTICE TECHNIQUE
Fred L. Heltsley *In* NASA. Langley Res. Center Vortex-Lattice Utilization 1976 p 145-162 refs Sponsored by AEDC (For availability see N76-28163 19-02)
CSCL 01A

N76-28278* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ROTARY MECHANISM FOR WIND TUNNEL STALL/SPIN STUDIES
Ronald E. Mancini, Dennis S. Matsuhiro, and Wilbur C. Vallotton *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 62-70 (For availability see N76-28272 19-18)
CSCL 14B

N76-28287* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MECHANICAL DESIGN OF NASA AMES RESEARCH CENTER VERTICAL MOTION SIMULATOR
David F. Engelbert, Allan P. Bakke, Mladen K. Chargin, and Wilbur C. Vallotton *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 155-164 ref (For availability see N76-28272 19-18)
CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-28241*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
APOLLO SOYUZ TEST PROJECT G&N ERROR ANALYSIS (CM 111/IMU 25)
S. B. Helfant Jun. 1975 35 p refs
(Contract NAS9-13809)
(NASA-CR-148547; R-888) Avail: NTIS HC $4.00 CSCL 17G

Data are presented on G&N system performance and operation for the Command Module.

N76-28242*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
SOLIDIFICATION UNDER ZERO GRAVITY: A LONG DURATION EXPOSURE FACILITY (LDEF) EXPERIMENT FOR AN EARLY SPACE SHUTTLE MISSION Final Report
John A. Bailey 14 May 1976 91 p refs
(Grant NsG-1136)
(NASA-CR-148160) Avail: NTIS HC $5.00 CSCL 22A

Project planning for two series of simple experiments on the effect of zero gravity on the melting and freezing of metals and nonmetals is described. The experiments will be performed in the Long Duration Exposure Facility, and their purpose will be to study: (1) the general morphology of metals and nonmetals during solidification, (2) the location of ullage space (liquid-vapor interfaces), and (3) the magnitude of surface tension driven convection during solidification of metals and nonmetals. The preliminary design of the experiments is presented. Details of the investigative approach, experimental procedure, experimental hardware, data reduction and analysis, and anticipated results are given. In addition a work plan and cost analysis are provided. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-28243*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PLANETARY/DOD ENTRY TECHNOLOGY FLIGHT EXPERIMENTS. VOLUME 1: EXECUTIVE SUMMARY Final Report, 1 Apr. 1975 - 29 Feb. 1976
H. E. Christensen, R. J. Krieger, W. R. McNeilly, and H. C. Vetter 29 Feb. 1976 57 p 4 Vol.
(Contract NAS2-8678)
(NASA-CR-137842; MDC-E1415-Vol-1) Avail: NTIS HC $4.50 CSCL 22A

The feasibility of using the space shuttle to launch planetary and DoD entry flight experiments was examined. The results of the program are presented in two parts: (1) simulating outer planet environments during an earth entry test, the prediction of Jovian and earth radiative heating dominated environments, mission strategy, booster performance and entry vehicle design, and (2) the DoD entry test needs for the 1980's, the use of the space shuttle to meet these DoD test needs, modifications of test procedures as pertaining to the space shuttle, modifications to the space shuttle to accommodate DoD test missions and the unique capabilities of the space shuttle. The major findings of this program are summarized. Author

N76-28244*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PLANETARY/DOD ENTRY TECHNOLOGY FLIGHT EXPERIMENTS. VOLUME 2: PLANETARY ENTRY FLIGHT EXPERIMENTS Final Report, 1 Apr. 1975 - 29 Feb. 1976
H. E. Christensen, R. J. Krieger, W. R. McNeilly, and H. C. Vetter 29 Feb. 1976 227 p refs 4 Vol.
(Contract NAS2-8678)
(NASA-CR-137843; MDC-E1415-Vol-2) Avail: NTIS HC $8.00 CSCL 22A

The technical feasibility of launching a high speed, earth entry vehicle from the space shuttle to advance technology for the exploration of the outer planets' atmospheres was established. Disciplines of thermodynamics, orbital mechanics, aerodynamics propulsion, structures, design, electronics and system integration focused on the goal of producing outer planet environments on a probe shaped vehicle during an earth entry. Major aspects of analysis and vehicle design studied include: planetary environments, earth entry environment capability, mission maneuvers, capabilities of shuttle upper stages, a comparison of earth entry planetary environments, experiment design and vehicle design. Author

N76-28245*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PLANETARY/DOD ENTRY TECHNOLOGY FLIGHT EXPERIMENTS. VOLUME 3: PLANETARY ENTRY FLIGHT EXPERIMENTS HANDBOOK Final Report, 1 Apr. 1975 - 29 Feb. 1976
H. E. Christensen, R. J. Frieger, W. R. McNeilly, and H. C. Vetter 29 Feb. 1976 88 p refs 4 Vol.
(Contract NAS2-8678)
(NASA-CR-137844; MDC-E1415-Vol-3) Avail: NTIS

HC $5.00 CSCL 22A

The environments produced by entry into Jupiter and Saturn atmospheres are summarized. Worst case design environments are identified and the effect of entry angle, type of atmosphere and ballistic coefficient variations are presented. The range of environments experienced during earth entry is parametrically described as a function of initial entry conditions. The sensitivity of these environments to vehicle ballistic coefficient and nose radius is also shown. An elliptical deorbit maneuver strategy is defined in terms of the velocity increment required versus initial entry conditions and apoapsis altitude. Mission time, ground track, and out of plane velocity penalties are also presented. Performance capabilities of typical shuttle launched boosters are described including the initial entry conditions attainable as a function of paylaod mass and apoapsis altitude. Author

N76-28246*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

PLANETARY/DOD ENTRY TECHNOLOGY FLIGHT EXPERIMENTS. VOLUME 4: DOD ENTRY FLIGHT EXPERIMENTS

Final Report, 1 Apr. 1975 - 29 Feb. 1976

H. E. Christensen, R. J. Krieger, W. R. McNeilly, and H. C. Vetter 29 Feb. 1976 277 p refs 4 Vol.

(Contract NAS2-8678)

(NASA-CR-137845; MDC-E1415-Vol-4) Avail: NTIS HC $9.25 CSCL 22A

For abstract, see vol. 1.

N76-28247# Groupe de Recherches de Geodesie Spatiale, Paris (France).

[BULLETIN OF THE SPACE GEODESY RESEARCH GROUP] [GROUPE DE RECHERCHES DE GEODESIE SPATIALE, BULLETIN NO. 14]

Dec. 1974 107 p refs Partly in ENGLISH and FRENCH

(GRGS-Bull-14) Avail: NTIS HC $5.50

A study of 13 arcs of satellites GEOS 2, BE-C, D1-D, and Anna 1b was made to analyze the long period changes in the mean longitude. The problem was expressed as a boundary value problem and 47 condition equations for even and odd degree harmonics of order 13 were derived. The earth tide perturbation on close earth satellites as formulated analytically to first order considering tesseral harmonics of longitude and latitude dependents Love numbers. Examples of long period perturbation for an actual geostatic satellite are given. The problem of discrepancy between actual total path length for electromagnetic pulse from a plant to a satellite compared to instantaneous distance at reflection time is discussed without resorting to heliocentric movement of the satellite. The method uses an iteration process on the transit time. For individual titles, see N76-28248 through N76-28250.

N76-28248 Groupe de Recherches de Geodesie Spatiale, Paris (France).

EQUATIONS OF CONDITION FOR 13TH-ORDER HARMONICS IN THE GEOPOTENTIAL

Georges Balmino and Christoph Reigber (Tech. Univ. Munich) *In its* Bull. of the Space Geodesy Res. Group No. 14 Dec. 1974 10 p refs Sponsored in part by Deut. Forschungsgemeinschaft (For availability see N76-28247 19-13)

13 different arcs of the satellites GEOS 2, BE-C, D1-D, and Anna 1b, which are in shallow resonance with the 13th-order harmonics in the geopotential were used for an analysis of the long period changes in the mean longitude in the sense of a boundary value problem. By this analysis 47 condition equations for even and odd degree harmonics of order 13 were derived.

Author (ESA)

N76-28249 Groupe de Recherches de Geodesie Spatiale, Paris (France).

ANALYTICAL EXPRESSIONS FOR EARTH TIDES PERTURBATIONS ON ARTIFICIAL SATELLITES

Georges Balmino *In its* Bull. of the Space Geodesy Res. Group No. 14 Dec. 1974 88 p refs In FRENCH; ENGLISH summary (For availability see N76-28247 19-13)

An analytical first order formulation of earth tides perturbations on close earth satellites has been derived, generalizing the expansions given by W. Kaula in 1969. In particular, tesseral harmonics of longitude (and latitude) dependent Love numbers have been considered. The solar and lunar tides perturbations have been treated separately. Some examples of long period perturbations for actual geodetic satellites are given.

Author (ESA)

N76-28250 Groupe de Recherches de Geodesie Spatiale, Paris (France).

HELIOCENTRIC ABERRATION FOR FORWARD-BACKWARD DISTANCE MEASUREMENT TO A SATELLITE

Odile Calame *In its* Bull. of the Space Geodesy Res. Group No. 14 Dec. 1974 8 p In FRENCH (For availability see N76-28247 19-13)

The problem of the discrepancy between actual total path length for an electromagnetic pulse from a planet to a natural satellite as compared to instantaneous distance at reflection time is discussed. A correction for this effect is shown to be computable without making use of the heliocentric movement of the satellite and by iterating on the transit time. The correction is basically a function of the planetocentric elongation of the target body in respect of the sun i.e. the difference between the planetocentric longitudes of the satellite and the sun. Author (ESA)

N76-28251# Groupe de Recherches de Geodesie Spatiale, Paris (France).

[BULLETIN OF THE SPACE GEODESY RESEARCH GROUP] [GROUPE DE RECHERCHES DE GEODESIE SPATIALE, BULLETIN NO. 15]

Mar. 1976 61 p refs Partly in ENGLISH and FRENCH

(GRGS-Bull-15) Avail: NTIS HC $4.50

Even and odd degree 13th order harmonics are determined from the analysis of stable near-resonant orbit of geodetic satellites (GEOS-2, BE-C, D1-D, Anna 1b, Oscar 07, and Thor Able Star). The problem of the motion of an artificial satellite undergoing atmospheric drag is solved analytically using the gravitational model of two fixed centers. For individual titles, see N76-28252 through N76-28253.

N76-28252 Technische Universitaet, Munich (West Germany). Sonderforschungsbereich 78 Satellitengeodaesie.

EVEN AND ODD DEGREE 13TH ORDER HARMONICS FROM ANALYSIS OF STABLE NEAR-RESONANT SATELLITE ORBITS

C. Reigber and G. Balmino (Groupe de Rech. de Geodesie Spatiale, Toulouse) *In* Groupe de Rech. de Geodesie Spatiale Bull. of the Space Geodesy Res. Group No. 15 Mar. 1976 p 1-46 refs Sponsored by Deut. Forschungsgemeinschaft and CNES (For availability see N76-28251 19-13)

The variation in the mean longitude for six satellites GEOS 2, BE-C, D1-D, Anna 1b, Oscar 07, and Thor Able Star in stable near-resonant orbits have been analyzed to derive 35 condition equations for even and odd degree harmonics of order 13 in the geopotential. From each satellite the amplitude spectrum of the resonance effect was obtained and a set of 35 condition equations was derived for the 13th-order harmonics. These equations have been solved by least squares calculation for an increasing number of unknowns. The recommended solution, going up to 30 is given. In addition, the normal equations of this solution were combined to all derived normal equation subsystems in the global solution in order to strengthen the 13th-order coefficients determination. Author (ESA)

N76-28253 Paris Univ. (France).

ANALYSIS OF THE ATMOSPHERIC DRAG INFLUENCE ON THE ARTIFICIAL SATELLITE MOTION [ETUDE ANALYTIQUE DE L'INFLUENCE DU FROTTEMENT ATMOSPHERIQUE SUR LE MOUVEMENT DES SATELLITES ARTIFICIELS]

In Groupe de Rech. de Geodesie Spatiale Bull. of the Space Geodesy Res. Group. No. 15 Mar. 1976 p 47-57 In FRENCH; ENGLISH summary (For availability see N76-28251 19-13)

The problem of the motion of an artificial satellite undergoing atmospheric drag is solved analytically using the gravitational model of two fixed centers. The equations of motion are written and, after some approximations, a method is applied for the generally adopted form of density models of the higher atmosphere. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-28254*# TRW Systems Group, Redondo Beach, Calif.
PHASE B: FINAL DEFINITION AND PRELIMINARY DESIGN STUDY FOR THE INITIAL ATMOSPHERIC CLOUD PHYSICS LABORATORY (ACPL), A SPACELAB MISSION PAYLOAD Supporting Research and Technology Report
Jun. 1976 10 p
(Contract NAS8-31844)
(NASA-CR-149929; DR-SE-243B) Avail: NTIS HC $3.50 CSCL 14B

A preliminary identification of the Supporting Research and Technology (SR&T) necessary during the planned evolution of atmospheric cloud physics is discussed. All requirements are for subsequent flights over its expected ten year lifetime. Those components identified as requiring some SR&T work prior to inclusion are listed. A data sheet is included for each item, briefly justifying the need, giving general objectives for the proposed development effort and identifying approximate schedule requirements on the program. Author

N76-28255*# TRW Systems Group, Redondo Beach, Calif.
FINAL DEFINITION AND PRELIMINARY DESIGN STUDY FOR THE INITIAL ATMOSPHERIC CLOUD PHYSICS LABORATORY (ACPL). PHASE B: A SPACELAB MISSION PAYLOAD
O. W. Clausen 30 Jun. 1976 198 p
(Contract NAS8-31844)
(NASA-CR-149930) Avail: NTIS HC $7.50 CSCL 14B

Engineering analyses and trades necessary to identify a preferred laboratory concept which will meet the science requirements were conducted. Results are summarized. Author

N76-28256*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE CONCEPT VERIFICATION TESTING OF MATERIALS SCIENCE PAYLOADS
C. S. Griner, M. H. Johnston, and A. Whitaker Jun. 1976 24 p
(NASA-TM-X-73320) Avail: NTIS HC $3.50 CSCL 14B

The concept Verification Testing (CVT) project at the Marshall Space Flight Center, Alabama, is a developmental activity that supports Shuttle Payload Projects such as Spacelab. It provides an operational 1-g environment for testing NASA and other agency experiment and support systems concepts that may be used in shuttle. A dedicated Materials Science Payload was tested in the General Purpose Laboratory to assess the requirements of a space processing payload on a Spacelab type facility. Physical and functional integration of the experiments into the facility was studied, and the impact of the experiments on the facility (and vice versa) was evaluated. A follow-up test designated CVT Test IVA was also held. The purpose of this test was to repeat Test IV experiments with a crew composed of selected and trained scientists. These personnel were not required to have prior knowledge of the materials science disciplines, but were required to have a basic knowledge of science and the scientific method. Author

N76-28257*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Progress Report, 1 Jul. 1975 - 30 Jun. 1976
D. G. Gisser, D. K. Frederick, G. N. Sandor, C. N. Shen, and S. W. Yerazunis 30 Jun. 1976 77 p refs
(Grant NGL-33-018-981)
(NASA-CR-148539; RPI-TR-MP-49) Avail: NTIS HC $5.00 CSCL 13F

Problems related to the design and control of an autonomous rover for the purpose of unmanned exploration of the planets were considered. Building on the basis of prior studies, a four wheeled rover of unusual mobility and maneuverability was further refined and tested under both laboratory and field conditions. A second major effort was made to develop autonomous guidance. Path selection systems capable of dealing with relatively formidable hazard and terrains involving various short range (1.0-3.0 meters), hazard detection systems using a triangulation detection concept were simulated and evaluated. The mechanical/electronic systems required to implement such a scheme were constructed and tested. These systems include: laser transmitter, photodetectors, the necessary data handling/controlling systems and a scanning mast. In addition, a telemetry system to interface the vehicle, the off-board computer and a remote control module for operator intervention were developed. Software for the autonomous control concept was written. All of the systems required for complete autonomous control were shown to be satisfactory except for that portion of the software relating to the handling of interrupt commands. Author

N76-28273* Planning Research Corp., Los Angeles, Calif.
SPACE SHUTTLE TAIL SERVICE MAST CONCEPT VERIFICATION
Robert T. Uda *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 1-10 refs (For availability see N76-28272 19-18) CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-28258*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TITIAN/CENTAUR D-1TTC-4 VIKING A FLIGHT DATA REPORT
Jul. 1976 161 p
(NASA-TM-X-73475; E-8860) Avail: NTIS HC $6.75 CSCL 22D

Titan/Centaur TC-4 was launched from the Eastern Test Range, Complex 41, at 05:22 PM EDT on Wednesday, August 20, 1975. This was the second operational flight of the newest NASA unmanned launch vehicle. The spacecraft was the Viking A, the first of two orbiting and landing missions to Mars planned for the 1975 Martian launch opportunity. The objective of the launch phase of the mission, to inject the Viking spacecraft onto the planned transfer orbit to Mars, was successfully accomplished. This report presents a review of the launch vehicle system flight data. Author

N76-28259*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TITAN/CENTAUR D1TTC-3 VIKING B FLIGHT DATA REPORT
Jul. 1976 153 p
(NASA-TM-X-73481; E-8863) Avail: NTIS HC $6.75 CSCL 22D

Titan/Centaur TC-3 was launched from the Eastern Test Range, Complex 41, at 02:34 PM EDT on Tuesday, September 9, 1975. This was the third operational flight of the newest NASA unmanned launch vehicle. The spacecraft was the Viking B, the second of two orbiting and landing missions to Mars planned for the 1975 Martian launch opportunity. The objective of the launch phase of the mission, to inject the Viking spacecraft onto the planned transfer orbit to Mars, was successfully accomplished. A review of the launch vehicle system flight data is presented. Author

N76-28260# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
THE SMS/GOES SPACE ENVIRONMENT MONITOR SUBSYSTEM
R. N. Grubb Dec. 1975 61 p refs
(PB-249593/5; NOAA-TM-ERL-SEL-42; NOAA-76011611)

Avail: NTIS HC $4.50 CSCL 22B

The Space Environment Monitor Subsystem, which is incorporated in the satellites SMS-1, SMS-2, and GOES-A, is described. The subsystem contains an energetic charged particle sensor, a magnetometer, and a soft solar X-ray detector and is intended for real time use by the Space Environment Services Center and to provide a long term scientific data base. Author

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N76-28261*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PRELIMINARY FEASIBILITY STUDY OF PALLET-ONLY MODE FOR MAGNETOSPHERIC AND PLASMAS IN SPACE PAYLOADS, VOLUME 4

Jun. 1976 321 p

(NASA-TM-X-72909; JSC-10683-Vol-4-Rev-A) Avail: NTIS HC $9.75 CSCL 22A

Results of studies performed on the magnetospheric and plasma portion of the AMPS are presented. Magnetospheric and plasma in space experiments and instruments are described along with packaging (palletization) concepts. The described magnetospheric and plasma experiments were considered as separate entities. Instrumentation ospheric and plasma experiments were considered as separate entities. Instrumentation requirements and operations were formulated to provide sufficient data for unambiguous interpretation of results without relying upon other experiments of the series. Where ground observations are specified, an assumption was made that large-scale additions or modifications to existing facilities were not required. Author

N76-28262*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

STS/SPACELAB PAYLOAD UTILIZATION PLANNING STUDY: EXECUTIVE SUMMARY

Jun. 1976 57 p

(Contract NAS8-31146)

(NASA-CR-149944; MDC-G6401; DPD-485; DR-MA-04) Avail: NTIS HC $4.50 CSCL 22A

The planning process recommended to meet the orbital flight requirements for the Space Transportation System and payload development, procurement, operations, and support leading to authorization and funding of STS and payload project activities is described. The rationale and rp primary products of STS utilization planning are summarized along with the implementation of the system. Major recommendations of the study are included. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N76-28263*# TRW Systems Group, Redondo Beach, Calif.

ADVANCED APPLICATION FLIGHT EXPERIMENTS PRECISION ATTITUDE DETERMINATION SYSTEM. VOLUME 1: STRAPDOWN STAR TRACKER DEVELOPMENT Final Report

31 Mar. 1976 116 p refs 2 Vol.

(Contract NAS1-12894)

(NASA-CR-144998; TRW-22817-6002-RU-00-Vol-1) Avail: NTIS HC $5.50 CSCL 17G

A strapdown star tracker is described which utilizes an image dissector tube in the photon counting mode. Stars as dim as +10 M sub v can be tracked with the 60 sq cm aperture of this device. This makes the 1 deg by 1 deg field of view practical without a decrease in star availability. A unique pulse processing circuitry is utilized which, combined with the photon counting technique, allows star magnitudes from +10 M sub v to 0 M sub v to be acquired and tracked without changing electronic circuitry or scaling. Position variation with star intensity is less than 2 arc seconds from +10 M sub v to 2.5 M sub v. The electronic design consists mostly of digital circuits; the search and track electronics are completely digital. The optical-mechanical structure is fabricated from graphite/epoxy composite material, and the optics were fabricated from Cervit. Both of these materials improve the thermal stability of the electro-optical boresight. Testing of the tracker was completely automated and used a collimated star source. Author

N76-28264*# TRW Systems Group, Redondo Beach, Calif.

ADVANCED APPLICATION FLIGHT EXPERIMENTS PRECISION ATTITUDE DETERMINATION SYSTEM. VOLUME 2: SYSTEM TESTS Final Report

31 Mar. 1976 325 p refs 2 Vol.

(Contract NAS1-12894)

(NASA-CR-144999; TRW-22817-6002-RU-00-Vol-2) Avail: NTIS HC $9.75 CSCL 17G

The performance capability of each of two precision attitude determination systems (PADS), one using a strapdown star tracker, and the other using a single-axis gimbal star tracker was measured in the laboratory under simulated orbit conditions. The primary focus of the evaluation was on the contribution to the total system accuracy by the star trackers, and the effectiveness of the software algorithms in functioning with actual sensor signals. A brief description of PADS, the laboratory test configuration and the test facility, is given along with a discussion of the data handling and display, laboratory computer programs, PADS performance evaluation programs, and the strapdown and gimbal system tests. Results are presented and discussed. Author

N76-28265*# Hughes Aircraft Co., El Segundo, Calif.

TRILATERATION RANGE AND RANGE RATE SYSTEM. VOLUME 1: CDA SYSTEM MANUAL

Feb. 1976 265 p

(Contract NAS5-21629)

(NASA-CR-144778; C3074-Vol-1; SCG-60047R-Vol-1) Avail: NTIS HC $9.00 CSCL 17B

This document is one of a series of manuals designed to provide the information required to operate and maintain the Command and Data Acquisition (CDA) equipment of the Trilateration Range and Range Rate (TRRR) System. Information pertaining to the equipment in the Trilateration Range and Range Rate System which is designed to interface with existing NASA equipment located at Wallops Island, Virginia is presented. Author

N76-28266*# Hughes Aircraft Co., El Segundo, Calif.

TRILATERATION RANGE AND RANGE RATE SYSTEM. VOLUME 2: TARS SYSTEM MANUAL

Feb. 1976 59 p

(Contract NAS5-21629)

(NASA-CR-144779; C3074-Vol-2; SCG-60048R-Vol-2) Avail: NTIS HC $4.50 CSCL 17B

Information pertaining to the equipment located in the Turn-Around Ranging Station is presented. Author

N76-28267*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SIMULATION AND MODELING OF THE DEEP SPACE RECEIVER INTERACTION WITH CHANNEL DECODING PERFORMANCE

Harry W. Jones, Jr. Jul. 1976 82 p refs

(NASA-TM-X-73140; A-6620) Avail: NTIS HC $5.00 CSCL 17B

Computer models were developed in an attempt to reproduce the sequential decoder computation curve of Deep Space Network (DSN) ground station receivers, by simulation of the binary data output of the Gaussian channel with the carrier phaselock loop and the subcarrier demodulator assembly. Simulations were run at bit rates equal to the powers of 2 from 8 to 2,048, and

agreement with DSN data was generally good above 32 bits per second. Simulation results at data rates of 8, 16, and 32 bits per second did not closely match experimental data. This simulation provides a more accurate prediction of DSN computation lengths than either current mathematical models or simulations without both the subcarrier demodulator and carrier loop. Author

N76-28268*# Computer Sciences Corp., Falls Church, Va. Aerospace Systems Operation.
DISASTER WARNING SYSTEM: SATELLITE FEASIBILITY AND COMPARISON WITH TERRESTRIAL SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY
John H. Spoor, W. H. Hodge, M. J. Fluk, and T. F. Bamford Sep. 1974 33 p refs 3 Vol.
(Contract NAS3-17795)
(NASA-CR-134622-Vol-1; R-3015-3-1-Vol-1) Avail: NTIS HC $4.00 CSCL 17B

The Disaster Warning System (DWS) is a conceptual system which will provide the National Weather Service (NWS) with communication services in the 1980s to help minimize losses caused by natural disasters. The object of this study is a comparative analysis between a terrestrial DWS and a satellite DWS. Baseline systems satisfying the NOAA requirements were synthesized in sufficient detail so that a comparison could be made in terms of performance and cost. The cost of both baseline systems is dominated by the disaster warning and spotter reporting functions. An effort was undertaken to reduce system cost through lower-capacity alternative systems generated by modifying the baseline systems. By reducing the number of required channels and modifying the spotter reporting techniques, alternative satellite systems were synthesized. A terrestrial alternative with the coverage reduced to an estimated 95 percent of the population was considered. Author

N76-28269*# Computer Sciences Corp., Falls Church, Va. Aerospace Systems Operation.
DISASTER WARNING SYSTEM: SATELLITE FEASIBILITY AND COMPARISON WITH TERRESTRIAL SYSTEMS. VOLUME 2: FINAL REPORT
John H. Spoor, W. H. Hodge, M. J. Fluk, and T. F. Bamford Sep. 1974 196 p refs 3 Vol.
(Contract NAS3-17795)
(NASA-CR-134622-Vol-2; R-3015-3-1-Vol-2) Avail: NTIS HC $7.50 CSCL 17B
For abstract, see Vol. 1.

N76-28270*# Computer Sciences Corp., Falls Church, Va. Aerospace Systems Operation.
DISASTER WARNING SYSTEM: SATELLITE FEASIBILITY AND COMPARISON WITH TERRESTRIAL SYSTEMS. VOLUME 3: APPENDICES
John H. Spoor, W. H. Hodge, M. J. Fluk, and T. F. Bamford Sep. 1974 123 p refs 3 Vol.
(Contract NAS3-17795)
(NASA-CR-134622-Vol-3; R-3015-3-1-Vol-3) Avail: NTIS HC $5.50 CSCL 17B
For abstract, see Vol. 1.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-28271*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
CONTROL OF SPINNING FLEXIBLE SPACECRAFT BY MODAL SYNTHESIS Final Technical Report
Leonard Meirovitch, Hugh F. VanLandingham, and H. Oez Jul. 1976 14 p refs Proposed for presentation at 27th Congr., Intern. Astronautical Federation, Anaheim, Calif., 10-16 Oct. 1976
(Grant NsG-1109)
(NASA-CR-148478) Avail: NTIS HC $3.50 CSCL 22B

A procedure is presented for the active control of a spinning flexible spacecraft. Such a system exhibits gyroscopic effects. The design of the controller is based on modal decomposition of the gyroscopic system. This modal decoupling procedure leads to a control mechanism implemented in modular form, which represents a distinct computational advantage over the control of the coupled system. Design procedures are demonstrated for two types of control algorithms, linear and nonlinear. The first represents classical linear feedback approach, and the second represents an application of on-off control, both types made feasible by the modal decomposition scheme. Author

N76-28272*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TENTH AEROSPACE MECHANISMS SYMPOSIUM
1 Jul. 1976 234 p refs Symp. held at Pasadena, Calif., 22-23 Apr. 1976; sponsored in part by LMSC
(Contract NAS7-100)
(NASA-CR-148515; JPL-TM-33-777) Avail: NTIS HC $8.00 CSCL 22D

Design studies and analyses were performed to describe the loads and dynamics of the space shuttle tail service masts. Of particular interest is the motion and interaction of the umbilical carrier plate, lanyard system, vacuum jacketed hoses, latches, links, and masthead. For individual titles, see N76-28273 through N76-28293.

N76-28273* Planning Research Corp., Los Angeles, Calif.
SPACE SHUTTLE TAIL SERVICE MAST CONCEPT VERIFICATION **c14**
Robert T. Uda *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 1-10 refs (For availability see N76-28272 19-18) CSCL 22D

Design studies and analyses were performed to describe the loads and dynamics of the space shuttle tail service masts (TSMs). Of particular interest are the motion and interaction of the umbilical carrier plate, lanyard system, vacuum jacketed hoses, latches, links, and masthead. A development test rig was designed and fabricated to obtain experimental data. The test program is designed to (1) verify the theoretical dynamics calculations, (2) prove the soundness of design concepts, and (3) elucidate problem areas (if any) in the design of mechanisms and structural components. Design, fabrication, and initiation of TSM development testing at Kennedy Space Center are described. Author

N76-28274* Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
A MOBILE PLANETARY LANDER UTILIZING ELASTIC LOOP SUSPENSION **c37**
W. Trautwein *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 11-25 refs (For availability see N76-28272 19-18) CSCL 13I

Efforts to increase the cost effectiveness of future lunar and planetary rover missions have led to the mobile lander concept, which replaces the landing legs of a soft-lander craft with a compact mobility system of sufficient strength to withstand the landing impact. The results of a mobile lander conceptual design effort based on existing NASA-Viking '75 hardware are presented. The elastic loop concept, developed as a post-Apollo rover technology, is found to meet stringent stowage, traction, power and weight requirements. Author

N76-28275* Rockwell International Corp., Canoga Park, Calif. Space Div.
APOLLO-SOYUZ TEST PROJECT DOCKING SYSTEM
W. L. Swan, Jr. *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 26-37 (For availability see N76-28272 19-18) CSCL 22B

The United States and Soviet Union in July 1975 successfully completed a joint space mission utilizing each country's spacecraft and the compatible docking system designed and fabricated by each country. The compatible docking system is described, along with the extensive research, development, and testing leading up to the successful mission. It also describes the formulation and implementation of methods for breaking the language barrier,

bridging the extensive distances for communication and travel, and adjusting to each country's different culture during the three-year development program. Author

N76-28276* Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHAPE OPTIMIZATION OF DISC-TYPE FLYWHEELS c44
Richard S. Nizza *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 38-51 refs (For availability see N76-28272 19-18)
CSCL 10C

Techniques were developed for presenting an analytical and graphical means for selecting an optimum flywheel system design, based on system requirements, geometric constraints, and weight limitations. The techniques for creating an analytical solution are formulated from energy and structural principals. The resulting flywheel design relates stress and strain pattern distribution, operating speeds, geometry, and specific energy levels. The design techniques incorporate the lowest stressed flywheel for any particular application and achieve the highest specific energy per unit flywheel weight possible. Stress and strain contour mapping and sectional profile plotting reflect the results of the structural behavior manifested under rotating conditions. This approach toward flywheel design is applicable to any metal flywheel, and permits the selection of the flywheel design to be based solely on the criteria of the system requirements that must be met, those that must be optimized, and those system parameters that may be permitted to vary. Author

N76-28277* Dornier-System G.m.b.H., Friedrichshafen (West Germany).
DESIGN PRINCIPLES OF A ROTATING MEDIUM SPEED MECHANISM c37
R. G. Hostenkamp, E. Achtermann, and R. H. Bentall (ESTC) *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 52-61 refs (For availability see N76-28272 19-18)
CSCL 13I

Design principles of a medium speed mechanism (MSM) are presented, including discussion on the relative merits of beryllium and aluminium as structural materials. Rotating at a speed of 60 rpm, the application envisaged for the MSM was as a despin bearing for the despun platform or despun antenna of a spin stabilized satellite. The MSM was built and tested to qualification level and is currently undergoing real time life testing. Author

N76-28278* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ROTARY MECHANISM FOR WIND TUNNEL STALL/SPIN STUDIES c09
Ronald E. Mancini, Dennis S. Matsuhiro, and Wilbur C. Vallotton *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 62-70 (For availability see N76-28272 19-18)
CSCL 14B

The critical problem of stall-spin characteristics of high performance aircraft and the need for experimental data in this area are reviewed. A rotary mechanism for obtaining this aerodynamic data in a conventional wind tunnel is presented. The intricacies of the drive systems and the articulation available through such a mechanism are described. Author

N76-28279* Lockheed Missiles and Space Co., Sunnyvale, Calif.
PIN PULLER IMPACT SHOCK ATTENUATION
Gary F. Auclair, Barry S. Leonard, Richard E. Robbins, and Wayne L. Proffitt *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 71-79 (For availability see N76-28272 19-18)
CSCL 22B

Design of a pin arresting mechanism for a pyrotechnically actuated pin puller is reviewed. The investigative approach is discussed and the impact shock test results for various candidate designs are presented. The selected pin arresting design reduced the peak value of the shock response spectrum by five to one. Author

N76-28280* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany).
THE HELIOS MECHANICAL DESPIN DRIVE ASSEMBLY FOR THE HIGH-GAIN ANTENNA REFLECTOR
E. J. W. Mueller *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 80-89 refs (For availability see N76-28272 19-18)
CSCL 22B

Helios is the German-American solar probe which comes within 0.31 Astronomical Units of the sun. A special Thermal design and a dry lubrication system have resulted in successful operation up to now, with Helios having finished its first orbit around the sun. Author

N76-28281* Hughes Aircraft Co., Culver City, Calif.
ASSURANCE OF LUBRICANT SUPPLY IN WET-LUBRICATED SPACE BEARINGS c37
Frank A. Glassow *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 90-103 refs (For availability see N76-28272 19-18)
CSCL 13I

Conventional lubrication techniques appear to be satisfactory, but rigorous proof of meeting a ten-year life requirement is lacking. One approach provides additional lubricant only when commanded from ground control, while the other passively augments lubrication at all times. Each technique has specific advantages, and selection should be related to the application to obtain optimum performance. Author

N76-28282* Planning Research Corp., Los Angeles, Calif.
DESIGN OF MECHANISMS TO LOCK/LATCH SYSTEMS UNDER ROTATIONAL OR TRANSLATIONAL MOTION c37
Rohinton P. Billimoria *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 104-115 refs (For availability see N76-28272 19-18)
CSCL 13I

Bodies/systems need to be stopped and locked/latched at the end of their path. Some examples of these systems in the aerospace industry (including launch vehicle, spacecraft, and the ground support equipment) are the command module access arm, service arms, docking module of the ASTP and the orbiter access arm for the space shuttle. Two major aspects are covered: (1) various methods of latching and (2) selection of the optimum method for latching, depending on the application and the design requirement criteria. Author

N76-28283* GTE Sylvania, Inc., Mountain View, Calif.
A HIGH RESOLUTION, ADJUSTABLE, LOCKABLE LASER MIRROR MOUNT c36
Curt H. Chadwick *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 116-124 (For availability see N76-28272 19-18)
CSCL 20E

A prototype high resolution, adjustable, lockable mirror mount is described, suitable for use as a resonator end mirror mount in fieldable lasers. The prototype was vibrated to 15g levels, 10-2000 Hz, and was shown to be stable to within 1 arc second and settable to an accuracy of 10 arc seconds. Improvements to be made to the prototype are outlined which will significantly improve the accuracy without sacrificing the other attributes of the prototype. Author

N76-28284* Stanford Univ., Calif. Guidance and Control Lab.
CAGING MECHANISM FOR A DRAG-FREE SATELLITE POSITION SENSOR
R. Hacker, J. Mathiesen, and D. B. DeBra *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 125-132 refs (For availability see N76-28272 19-18)
CSCL 22B

A disturbance compensation system for satellites based on the drag-free concept was mechanized and flown, using a spherical proof mass and a cam-guided caging mechanism. The caging mechanism controls the location of the proof mass for testing and constrains it during launch. Design requirements, design details, and hardware are described. Author

N76-28285* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany).
THE HELIOS EXPERIMENT 5 ANTENNA MECHANISM
J. W. Mueller *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 133-142 refs (For availability see N76-28272 19-18)
CSCL 22B

The Experiment 5 Antenna deployment problem onboard Helios A, the failure analysis, and changes in design, test, and

operation which led to a successful deployment of both antennas during the early Helios B mission phase are described. Author

N76-28286* Fairchild Space and Electronics Co., Germantown, Md.
HIGH STABILITY DEPLOYABLE BOOM
Gordon A. Smith, Thomas G. Berry, and Lamont DiBiasi *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 143-154 (For availability see N76-28272 19-18)
CSCL 22B

Meaningful magnetic field vector measurements in space require accurate placement of a magnetometer beyond the magnetic fields of a spacecraft. The design and development of a deployable boom is described which ensures accurate deployment of an instrument package and maintains high stability after extension. Author

N76-28287* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MECHANICAL DESIGN OF NASA AMES RESEARCH CENTER VERTICAL MOTION SIMULATOR c09
David F. Engelbert, Allan P. Bakke, Mladen K. Chargin, and Wilbur C. Vallotton *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 155-164 ref (For availability see N76-28272 19-18)
CSCL 14B

NASA has designed and is constructing a new flight simulator with large vertical travel. Several aspects of the mechanical design of this Vertical Motion Simulator (VMS) are discussed, including the multiple rack and pinion vertical drive, a pneumatic equilibration system, and the friction-damped rigid link catenaries used as cable supports. Author

N76-28288* TRW Systems Group, Redondo Beach, Calif.
A SIMULTANEOUS SPIN/EJECT MECHANISM FOR AEROSPACE PAYLOADS
G. Dan Palmer and Tom N. Banks (AVCO System Div.) *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 165-174 (For availability see N76-28272 19-18)
(Contracts F04701-74-C-0325; F04701-74-C-0326; F04701-74-C-0328)
CSCL 22B

A simultaneous spin/eject mechanism was developed for aerospace applications requiring a compact, passive device which would accommodate payload support and controlled-release functions, and which would provide a highly accurate spin-ejection motion to the payload. The mechanism satisfied the requirements and is adaptable to other deployment applications. Author

N76-28289* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN EVOLUTION OF A LOW SHOCK RELEASE NUT
David H. Otth and William Gordon (Hi-Shear Corp.) *In its* 10th Aerospace Mech. Symp. 1 Jul. 1976 p 175-184 (For availability see N76-28272 19-18)
(Contract NAS7-100)
CSCL 22B

Design improvements and detailed functional analyses are reviewed to trace the development of a pyroactuated release device with segmented thread design from its intermediate design into one that reduces the levels of shock spectra generated during its operation by 50%. Comparisons of shock output and internal load distribution are presented, along with descriptions of mechanical operation for both designs. Results also show the potential areas where design development activity can gain further progress in lowering actuation shock levels. Author

N76-28290* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ARRAY DRIVE SYSTEM c37
Frank D. Berkopec, John C. Sturman, and R. W. Stanhouse (GE, Philadelphia) *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 185-197 refs (For availability see N76-28272 19-18)
CSCL 22B

A solar array drive system consisting of a solar array drive mechanism and the corresponding solar array drive electronics is being developed. The principal feature of the solar array drive mechanism is its bidirectional capability which enables its use in mechanical redundancy. The solar array drive system is of a widely applicable design. This configuration will be tested to determine its acceptability for generic mission sets. Foremost of the testing to be performed is the testing for extended duration. Author

N76-28291* Martin Marietta Corp., Denver, Colo.
VISCOUS ROTARY VANE ACTUATOR/DAMPER
Jack D. Harper *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 198-207 Prepared for JPL (For availability see N76-28272 19-18)
(Contract NAS7-100)
CSCL 22B

A compact viscous rotary actuator/damper for use on the Mariner '71 and Viking Programs was developed. Several functions were combined into this single mechanism to control the deployment, latching, and damping of the solar panel arrays used on these space vehicles. The design, development, and testing of the actuator/damper are described, and major problems encountered are discussed. Author

N76-28292* Beckman Instruments, Inc., Anaheim, Calif. Advanced Technology Operations.
VIKING GC/MS MECHANISMS DESIGN AND PERFORMANCE
C. Peter Chase and August O. Weilbach *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 208-217 (For availability see N76-28272 19-18)
CSCL 22B

The Viking Lander gas chromatograph/mass spectrometer will analyze pyrolyzed samples of the Martian surface for organic content. The surface-sample loader and pyrolyzer assembly (SSPLA) is described, along with the major problems encountered during design and testing. Three mechanisms were developed to implement the required SSLPA functions: (1) a soil loader that forces soil from a filled rotating funnel into each of three ovens located on a carriage, (2) a Geneva drive for rotating and precisely indexing the ovens to receive sample, and (3) a toggle-clamp mechanism for sealing the ovens by forcing circular double knife edges into gold sealing surfaces. Author

N76-28293* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EVOLUTION OF THE VIKING LANDING GEAR
Joe C. Pohlen, Bruce D. Maytum, Ira W. Ramsey, and U. J. Blanchard *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 218-228 Prepared in cooperation with Martin-Marietta Corp., Denver (For availability see N76-28272 19-18)
(Contract NAS1-9000)
CSCL 22B

The primary function of the landing gear is to dissipate touchdown energy in a controlled fashion that minimizes the landing shock for onboard components while maximizing ground clearance and the probability of landing stability over the range of possible surface and touchdown parameter variations. Many other mission requirements and constraints were translated into the evolving Viking landing gear design as they arose. Hence, design considerations included such factors as prelaunch heat sterilization and noncontamination of the Martian landing site, gear stowage and deployment, terminal descent engine shutdown initiation, structural load attenuation, hard/soft landing surface capability, reliability, weight, and post-landed stability. Author

N76-28294*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXTERNAL TANK GASEOUS OXYGEN LINE SIMULATED LIGHTNING TESTS
Hubert E. Smith and R. M. Avery Jul. 1976 34 p
(NASA-TM-X-73322) Avail: NTIS HC $4.00 CSCL 22B

Tests were made to evaluate the effects of lightning strikes on the shuttle external tank gaseous oxygen pressurization line. This line, designed to conduct gaseous oxygen may also act as a lightning conductor. Questions have been raised as to the potential hazard of this line as a lightning conductor with speculation as to the damage that might occur to the pressurization line, and the adjacent thermal protective surfaces, from a lightning strike. The region of investigation was from above the cone of the launch tower lightning protection to 15.24 km (50, 000 ft) altitude. Tests were performed on samples of thin wall stainless steel tubing filled with gaseous oxygen under simulated flight

conditions. No specimen malfunctions occurred when the tests were conducted according to JSC specifications. Based on the JSC specifications and the results of these tests, it is concluded that a lightning strike will not cause a malfunction of the shuttle external tank gaseous oxygen line made of the representative material tested. Author

N76-28295# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

INFLUENCE OF STRUCTURAL FLEXIBILITY ON A SINGLE-AXIS LINEAR ATTITUDE CONTROLLER

Tarek Abdel-Rahman Feb. 1976 46 p refs
(UTIAS-TN-198) Avail: NTIS HC $4.00

The effect of structural flexibility on a linear attitude control system employing a reaction wheel is investigated. The parameters of a compensator in the form of feedback are chosen in an optimal way: to minimize the real part of right-most root of the system characteristic equation. This is done assuming the satellite to be rigid. Then the effects of flexibility are investigated through stability diagrams drawn by inspection of the real parts of the roots of the characteristic equation, showing stable and unstable regions. Root locus plots for different parameter values are also used to illustrate the effect of flexibility on the roots. Increasing the structural damping and designing the appendages as rigidly as possible are important means of insuring stability of the control system. Otherwise, the controller should be designed with structural flexibility explicitly included. The flexibility investigations have been carried out for two general types of flexible vibration, namely 'rod-like' behavior and 'membrane-like behavior. A method to counteract the destabilizing effect that may arise due to structural flexibility is also given. Author

N76-28296*# National Aeronautics and Space Administration, Washington, D.C.

VIKING 1: EARLY RESULTS

21 Aug. 1976 76 p
(NASA-SP-408) Avail: NTIS HC $2.00 CSCL 22B

A brief outline of the Viking 1 mission to Mars is followed by descriptions of the Martian landing site and the scientific instrumentation aboard Viking 1 orbiter and lander. Measurements of the Martian atmosphere provided data on its molecular composition, temperature and pressure. The detection of nitrogen in the Martian atmosphere indicates the existence of life. Panoramic photographs of the Martian surface were also obtained and are shown. Preliminary chemical and biological investigations on samples of Martian soil indicated the presence of the elements iron, calcium, silicon, titanium and aluminum as major constituents. Observed biochemical reactions were judged conducive of biological activity. G.G.

N76-28297# European Space Agency, Paris (France).

DYNAMICS AND CONTROL OF NON-RIGID SPACE VEHICLES

1976 338 p refs Partly in ENGLISH and partly in FRENCH Proc. of Symp., held at Frascati, Italy, 24-26 May 1976 Sponsored in part by ESA
Avail: NTIS HC $10.00

Topics are presented in the field of flexible spacecraft configurations. Dynamic models are reviewed for spinning and non-spinning satellites. The attitude stability of flexible satellites is discussed. Applications are described of modern control theory and the design of control systems for these configurations is outlined. Test and flight verifications are reported, and some special dynamics problems are dealt with. For individual titles, see N76-28298 through N76-28332.

N76-28298* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

FREE VIBRATION ANALYSIS OF SPINNING FLEXIBLE SPACE STRUCTURES

K. K. Gupta *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 4 p refs (For availability see N76-28297 19-18)
(Contract NAS7-100)

Efficient computation of natural frequencies and associated free vibration modes of spinning flexible structures is required to accurately determine the nature of interaction between the flexible structure and the attitude control system, which is vital in relating control torques to attitude angles. While structural discretization is effected by the finite element method, the resulting eigenvalue problem is solved by a combined Sturm sequence and inverse iteration procedure that yields a few specified roots and associated vectors. An eigenvalue procedure, based on a simultaneous iteration technique, provides efficient computation of the first few roots and vectors; a modal synthesis procedure proves to be useful for eigenproblem solutions of unusual structures such as spacecraft. Author (ESA)

N76-28299 Liege Univ. (Belgium). Lab. de Techniques Aeronautiques et Spatiales.

NONLINEAR DYNAMICS OF FLEXIBLE BODIES

B. FraeijsdeVeubeke *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 9 p refs (For availability see N76-28297 19-18)

The mean motion of a flexible body is usually taken to satisfy the Tisserand conditions of zero relative momentum and angular momentum associated to a minimum of the relative kinetic energy. A choice minimizing the mean square of relative displacements is proposed. The zero momentum condition is preserved but the angular momentum condition is linearized in such a way that the relative displacements are representable exactly by an expansion in natural elastic vibration modes. Hamilton's principle is used to derive all equations of motion, including the mean one, by using the concept of quasi-coordinates. Gravitational potential and thrust vectors, as locally oriented by the body motion and deformation, are accounted. Distortions may be large provided strains remain small.
Author (ESA)

N76-28300* Wisconsin Univ., Madison. Dept. of Engineering Mechanics.

ANALYSIS OF GENERALIZED FORCES IN THE SINGULAR PERTURBATION EQUATIONS OF MOTION OF FLEXIBLE SATELLITES

T. C. Huang and A. Das (GE, Valley Forge, Pa.) *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 9 p refs (For availability see N76-28297 19-18)
(Contracts NAS5-11542; NAS5-21798)

The formulation and existence of a generalized force in the singularly perturbed formulation of flexible satellites is described. The concept of this force sharply reduces the number of degrees of freedom and the equations of motion of satellites with a large number of flexible elements. The force is analyzed to demonstrate its existence and convergence criteria. The complete solution has been obtained in three time zones - the inner boundary layer, the outer boundary layer, and the large time extending beyond these boundary layers. A stability criterion is proposed for this generalized force. Author (ESA)

N76-28301 European Space Research and Technology Center, Noordwijk (Netherlands).

EXACT MODAL ANALYSIS FOR SPINNING FLEXIBLE SPACECRAFT

Daniel H. L. Poelaert *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 8 p refs (For availability see N76-28297 19-18)
HC $3.50

It is shown that with existing theories, it is possible to solve exactly the eigenvalue problem associated to spinning flexible structure, without any a priori spatial discretization of the flexible parts and without introducing any truncated series of assumed modes to expand the deformation field of the actual system. Instead, by working in the frequency domain, an exact solution of the partial differential equations for the continuum is fed into the six ordinary differential equations for the motion of the reference axes, reducing to six, the dimension of the eigenvalue problem to be solved. Results concerning the modal analysis for the European satellite GEOS using the above method are given.
Author (ESA)

N76-28302 European Space Operations Center, Darmstadt (West Germany).

DYNAMICS OF SPINNING SATELLITES MODELLED AS A RIGID CENTRAL BODY AND SPHERICAL PENDULUMS AS APPENDAGES

F. Janssens *In* ESA Dyn. and Control of Non-rigid Space Vehicles refs (For availability see N76-28297 19-18)

The motion of a spherical pendulum in a centrifugal force field is discussed. This constitutes a preliminary problem where the central body is uninfluenced by the booms. The typical frequencies for meridian and equatorial oscillations are derived, these directions being defined in their usual state with respect to the spin axis. The main effect of linearizing the equations is found to take away the basic asymmetry between forward and backward swings due to the coriolis force. The equations of motion for a rotating rigid body on which n spherical pendula are attached are set up and linearized for n = 2. In the discussion of the natural frequencies of this system a clear distinction is made between the frequencies and the variables affected by such a system frequency. In the case of a coupled nutation meridian antisymmetric - equatorial symmetric mode a special investigation is made of the particular pendulum length for which one expects that the nutation frequency equals the equatorial-symmetric frequency. The evolution of the nutation of the central body due to the axial thrusting is also discussed. Author (ESA)

N76-28303 British Aircraft Corp. (Operating) Ltd., Bristol (England).

DYNAMICS MODELLING AND FORMULATION TECHNIQUES FOR NON-RIGID SPACECRAFT

C. J. H. Williams *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 18 P refs (For availability see N76-28297 19-18)

Current techniques for modelling the spacecraft structure and formulating the equations of motion are surveyed. Topics discussed include distributed parameter, discrete parameter, N-body and finite element modelling; floating and fixed spacecraft reference frames; use of quaternion parameters for attitude co-ordinates; quasi co-ordinate forms of Lagrange's equations; and modal analysis using global modes, cantilever modes and assumed models. A number of examples is presented. Author (ESA)

N76-28304 Technische Universitaet, Munich (West Germany). Inst. B fuer Mechanik.

SYSTEMS EQUATIONS AND CONTROL OF AN ORBITING FLEXIBLE TELESCOPE

Hartmut Bremer *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 P refs (For availability see N76-28297 19-18)

Hybrid non-rigid spacecrafts such as an elastic telescope with internal rigid bodies cannot easily be treated by direct transfer of the methods of elastodynamics. By a generalization of Rayleigh's quotient, however, a useful approximation can be made in order to obtain the equations of motion including the coupling moment between elastic vibrations and rigid body motion. After considering critical phenomena due to nonlinearities, the systems equations are formulated as time-dependent state equations. These are treated by known procedures in order to derive an optimal control for the pitch motion. Author (ESA)

N76-28305 Dornier-System G.m.b.H., Friedrichshafen (West Germany).

DYNAMICS OF THE SOFTMOUNTED SPACELAB INSTRUMENT POINTING SYSTEM

F. Urban, K. Ernsberger, and H. Heusmann (ESTEC) *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 P refs (For availability see N76-28297 19-18)

The description and analysis of a new kind of a 3-axis controlled gimbal system for very precise pointing and stabilization of Spacelab experiments are presented. A special feature of this design is the flexible suspension (softmount) which reduces the sensitivity of this gimbal configuration to disturbances caused by crew motion and Shuttle Orbiter jet firing. A model regarding three bodies of interest, i.e. the Orbiter, the softmount and the instrument, is set up and the equations of motion are derived. The model is used in a digital computer simulation revealing the necessary insight into the dynamic behavior of softmount and instrument motions, especially serving for parameter definition and performance evaluation. Author (ESA)

N76-28306 Societe Nationale Industrielle Aerospatiale, Cannes (France).

FINITE ELEMENT DYNAMIC ANALYSIS OF LARGE DIMENSIONAL FLEXIBLE SOLAR ARRAYS: NECESSITY OF MODAL TRUNCATION FOR THE SIMULATION OF SPACECRAFT CONTROL MANOEUVRES

G. LeGuilly and J. G. Ferrante (ESTEC) *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 12 P refs (For availability see N76-28297 19-18)

As the power requirements for future generation of communication satellites continue to increase, new designs of large solar arrays must be investigated. For this purpose flexible roll-out/fold-out structures represent a very interesting solution. The finite element idealization of such structures and the calculation of fixed base eigen modes by means of a special purpose computer program called DAFSA (Dynamic Analysis of Solar Arrays) are dealt with. The interpretation of these modes is given and the utilization of the convergence property of their associated participation gains is discussed. Special emphasis is put on local and global modes, and also on the representativity of flexible effect when modal truncation is unavoidable. Author (ESA)

N76-28307 European Space Research and Technology Center, Noordwijk (Netherlands). Aerosat SPO Div.

EFFECTS OF FLEXIBILITY IN AN ASYMMETRIC DUAL-SPIN SPACECRAFT

B. N. Agrawal *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 8 P refs (For availability see N76-28297 19-18)

The effects of the flexibility in the momentum wheel of an asymmetric dual-spin spacecraft on its attitude stability are discussed. The gyroscopic equations of motion are normalized and the possible instability regions due to the stiffness inequality are obtained. The instability criteria are given explicitly. It is found that several instability regions can exist. However, for a typical spacecraft the important instability regions occur when the rotor speed is in the neighborhood of either the second natural frequency of the spacecraft or half of the sum of the first and second natural frequencies. As an example, natural frequencies and critical speeds are obtained for a typical spacecraft. Author (ESA)

N76-28308 Pennsylvania State Univ., University Park.

ATTITUDE CONTROL OF SYNCHRONOUS SATELLITES POSSESSING FLEXIBLE SOLAR ARRAYS USING A DOUBLE GIMBALED MOMENTUM WHEEL

Stanley E. Hillard *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 12 P refs (For availability see N76-28297 19-18)

A symmetric vehicle possessing two large, highly flexible solar wings in synchronous orbit is investigated. Each wing is comprised of a solar cell blanket, rigid tip piece, and flexible support boom. The linearized satellite attitude equations are presented using a hybrid coordinate scheme along with ancillary flexible array component relations and their applicable boundary conditions. Continuous deformation coordinates are expressed in terms of normal modes while vehicle attitude perturbations are expressed using Euler angles. The uncontrolled vehicle natural frequencies are determined and the effects of inertial, material, and geometrical parameters are calculated. Acceptable control laws are presented assuming a double gimbaled momentum wheel configuration and attitude control transfer functions are determined. The effects of appendage flexibility are isolated and criteria are established for system stability using well known techniques. Author (ESA)

N76-28309 Louvain Univ. (Belgium).

MODERN SPACECRAFT DYNAMICS INVESTIGATION

P. Boland *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 9 p refs (For availability see N76-28297 19-18)

The modeling of spacecraft as systems of interconnected deformable bodies providing a general approach to the problem of space vehicle dynamics simulation is considered. Derivation procedures for vectorial and matrix equations are examined. Flexibility is accommodated by the adoption of modal coordinates. The latter are truncated after transformation of the deformation equations is performed so as to allow numerical simulation. The technique is presently confined to non-rotating structures. The programming of this formulation is complete. Mariner-Jupiter-Saturn 77 has been used as a test case. Structural data were available from the Jet Propulsion Laboratory which worked on the same problem using a different technique. Results have been

compared and provided a valuable cross-check of the methods.
Author (ESA)

N76-28310 Technische Hochschule, Vienna (Austria). Inst. fuer Mechanik.
ATTITUDE STABILITY OF SATELLITES WITH FLEXIBLE APPENDAGES
G. Kiesselbach *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 7 p refs (For availability see N76-28297 19-18)

With the aid of the theorem of Zubov the attitude stability of a satellite consisting of a rigid central body and a number of flexible appendages such as antennas is investigated. As usual the Hamiltonian is chosen as testing functional but also as stability measure for determining the difference between the disturbed and the undisturbed motion. The investigation proceeds in two steps. In the first step the stationary positions of the satellite are determined. In the second step the stability of these stationary positions is investigated. As an example, the planar motion of a satellite with two flexible appendages located at 180 deg from each other is considered and the stability of the trivial and the nontrivial positions is investigated. Author (ESA)

N76-28311 National Aerospace Lab., Tokyo (Japan).
RESULTS OF NUMERICAL DETERMINATION OF POLES AND ZEROS OF TRANSFER FUNCTION FOR FLEXIBLE SPACECRAFT ATTITUDE CONTROL
Y. Ohkami and P. W. Likins *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 p refs (For availability see N76-28297 19-18)

Determination procedures of poles and zeros of matrix transfer functions are presented for flexible spacecraft attitude control. The algorithms are essentially based on methods previously established and some aspects of the computer programming for the construction of the matrices whose eigenvalues are poles or zeros of the transfer functions of interest. A brief investigation is also made into the eigenvalue problems involved. Numerical computations on a digital computer were carried out for an idealized spacecraft with symmetric solar panels, and the results demonstrate the dependency of open loop pole and zero configuration on sensor location and rotation angle of solar panel. Author (ESA)

N76-28312 Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
A GENERAL STABILITY PRINCIPLE FOR SPINNING FLEXIBLE BODIES WITH APPLICATION TO THE PROPELLANT MIGRATION. WOBBLE AMPLIFICATION EFFECT
J. E. McIntyre and M. I. Miyagi *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 17 p refs (For availability see N76-28297 19-18)

With the assumption that no structural member will fail in divergence under the equilibrium centrifugal field loading, it is shown that there exists but one mechanism that can produce unstable behavior on a spinning flexible satellite whose roll-to-pitch ratio is greater than unity. This mechanism is closely associated with the change in spacecraft balance accompanying the deformation of a flexible element. Specifically, the misalignment between the design and actual spin axes occurring in the laboratory where the vehicle is spin balanced in a rigid configuration (i.e., with appendages stowed and with the propellant tanks empty) is amplified in the on-orbit configuration by the presence of flexible elements. As the stability boundary is approached, the amplification approaches infinity with large angular separations between the design and actual spin axes resulting. An example of this phenomenon is given involving the migration of fuel between tanks in a manifolded propellant system. Author (ESA)

N76-28313 British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
PARAMETRIC STUDIES ASSOCIATED WITH SPIN-STABILISED FLEXIBLE SPACECRAFT
R. H. Dennett *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 13 p refs (For availability see N76-28297 19-18)

The trend towards incorporating several sets of deployable booms on spinning passively controlled spacecraft (for example, GEOS) can result in significant configuration (inertia) asymmetry and marginal operational system stability, with the attendant problems in control. The effects of various flexible elements on the conditions for stability of the equilibrium configuration are examined. Modal response and damping are analyzed for a configuration which can be modelled by a (modified) centerbody plus a symmetric pair of long flexible radial booms, represented as pendula. Response is shown to be significantly influenced by thruster position and maneuver strategy. The modal damping provided by an on-board nutation damper, augmented by the natural damping of the booms, is examined against possible system requirements. A discussion is included on the effects of boom stiffness, and the long-term non-linear effects on system spinrate of attitude maneuvers. Author (ESA)

N76-28314 RCA Labs., Princeton, N.J. Electronics Div.
ATTITUDE STABILITY OF A FLEXIBLE DUAL-SPIN SPACECRAFT WITH ACTIVE NUTATION DAMPING USING PRODUCTS OF INERTIA
G. T. Tseng and K. J. Phillips *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 8 p refs (For availability see N76-28297 19-18)

A Nyquist stability analysis of an actively controlled flexible dual-spin spacecraft is presented. The control system employs an active nutation damping scheme utilizing spacecraft products of inertia. Both pitch control and nutation damping are accomplished through torquing a single momentum wheel. It is demonstrated that a nutational damping time constant of the order of a few minutes (3.5 minutes in the present model) is attainable for a particular spacecraft system. Sufficient stability margins were established even though the flexural frequency band overlaps the control system bandwidths. Author (ESA)

N76-28315 Louvain Univ. (Belgium).
STATE AND PARAMETER ESTIMATION TECHNIQUES APPLIED TO FLEXIBLE SATELLITES
P. Y. Willems *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 p refs (For availability see N76-28297 19-18)

Using an appropriate model, the motion of flexible spacecraft around an equilibrium can be described by a set of linear ordinary differential equations. The coefficients of these equations and the equilibrium state use functions of the physical parameters of the system. Two techniques for solving the estimation-identification problem are presented. The first one is based on the nonlinear estimation of an extended state consisting of the system variables and of the physical parameters. Approximate methods are presented and it is concluded that the extended Kalman filter is well suited for practical implementation. The second method is based on an optimal search of parameters by use of sequential decision technique. The method is applied in a particular case to the physical problem under consideration. Finally the two techniques are compared. Author (ESA)

N76-28316 Leeds Univ. (England). Dept. of Mechanical Engineering.
FLEXIBLE SPACE VEHICLE CONTROL BASED ON STATE OBSERVATION AND LYAPUNOV'S METHOD
E. H. Smith and K. F. Gill *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 7 p refs (For availability see N76-28297 19-18)

A control scheme for a single-mode flexible satellite is described which uses an application of Lyapunov's second method to derive the switching law for a relay controller. The method requires complete knowledge of the state of the system. Because such information is not normally available, a Luenberger observer is employed to estimate the states from the output of an attitude sensor. It is shown that flexure can be controlled and a high pointing-accuracy maintained, even in the presence of severe plant and input mismatch, using existing control equipment.
Author (ESA)

N76-28317* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN APPLICATION OF MODERN CONTROL THEORY TO AN ELASTIC SPACECRAFT
Victor Larson and Peter W. Likins (Univ. of Calif., Los Angeles) *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 5 p refs Sponsored in part by NASA (For availability see

N76-28297 19-18)

Results are presented to illustrate the application of established procedures of linear, quadratic, Gaussian optimal estimation and control to a spacecraft with dynamically significant elastic appendages. Interpretations are provided in both time domain and frequency domain, and conclusions are drawn for a wide class of problems of flexible spacecraft attitude control.

Author (ESA)

N76-28318 Universite des Sciences et Techniques du Languedoc, Montpellier (France). Lab. d'Automatique.

THE CONTROLLABILITY OF MULTI-BODY MECHANISMS

A. Liegeois and J. P. Simon *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 18 p refs (For availability see N76-28297 19-18)

The Lagrangian formalism is used to derive the general dynamic model of multi-body mechanisms in such a way that the control forces and the measured coordinates appear explicitly. The equations are then linearized and put in a state-space matrix equation. It is proposed that controllability studies make use of the canonical Jordan form, which allows comparing quantitatively the effects of the various control forces on the system's modes. The mathematical background and the corresponding algorithm are given, which leads to the canonical representation. The suggested approach is applied to actual problems, and the computer results are given. Author (ESA)

N76-28319* Howard Univ., Washington, D.C. Dept. of Mechanical Engineering.

OPTIMAL CONTROL OF SPIN STABILIZED SPACECRAFT WITH TELESCOPING APPENDAGES

P. M. Bainum and R. Sellappan *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 12 p refs (For availability see N76-28297 19-18)

(Grant NsG-1181)

The control of a spin-stabilized spacecraft consisting of a rigid central hub and one or two movable offset telescoping booms (with end masses) is considered. The equations of rotational motion are linearized about either of two desired final states. A control law for the boom and mass position is sought such that a quadratic cost functional involving the weighted components of angular velocity plus the control is minimized when the final time is unspecified and involves the solution of the matrix Riccati algebraic equation. For three-axis control more than one offset boom (orthogonal to each other) is required. For two-axis control with a single boom offset from a symmetrical hub, an analytic solution is obtained; when this system is used for nutation decay the time constant is one order of magnitude smaller than previously achieved using non-optimal control logic. For the general case results are obtained numerically. Author (ESA)

N76-28320 Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).

ON THE OBSERVABILITY OF THE DEFORMABLE MODES IN A CLASS OF NON-RIGID SATELLITES

E. Jonckheere *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 12 p refs Sponsored in part by ESA (For availability see N76-28297 19-18)

(Contract F44620-71-C-0067)

The problem of observing the deformable modes in a class of non-rigid satellites is considered. The satellites under consideration are those consisting of a main rigid body on which two flexible panels are symmetrically connected. After modeling the satellite by idealizing the flexible panels as a finite set of interconnected rigid bodies, it can be verified that the deformable modes are observable by the measurements provided by the sensors located in the main rigid body. However, for a realistic range of parameter values, the deformable modes exhibit a weak observability property. An effort is made to define precisely this concept and to investigate its practical consequences. It is shown how the deformable modes should be considered as weakly observable. A root-locus technique which is useful to detect weakly observable modes and which gives almost a measure of observability is presented. Author (ESA)

N76-28321 California Univ., Los Angeles.

INTERACTION PROBLEMS BETWEEN THE DYNAMICS AND CONTROL SYSTEM FOR NONRIGID SPACECRAFT

Peter W. Likins *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 7 p refs (For availability see N76-28297 19-18)

Specific case studies are employed to illustrate the importance of dynamic modeling and dynamic analysis in the development of attitude control systems for modern spacecraft, which are characterized by stringent pointing requirements and dynamically significant nonrigidity. Examples include spacecraft that exhibited flight anomalies traced to nonrigidity, and other spacecraft for which nonrigidity has presented problems that were recognized before launch. Lessons are drawn from experience with the Mariner Venus/Mercury spacecraft, the Viking spacecraft, the Mariner Jupiter/Saturn spacecraft, the Tactical Communications Satellite 1, the Advanced Technology Satellite 5, and a series of earlier American satellites. Author (ESA)

N76-28322 Engins Matra, Velizy (France).

DESIGN OF A CONTROL LOOP WITH FLEXIBILITY AND IN-FLIGHT IDENTIFICATION OF THE FLEXIBLE MODES

A. Beysens *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 11 p (For availability see N76-28297 19-18)

The principles which have led to the present design of attitude control loops of the geostationary OTS during station keeping maneuvers are introduced, taking into account the flexibility of the solar arrays. The configuration of the loop is detailed: sensor, corrective network, threshold, modulator and thrusters, and the setting are discussed to provide efficient damping of the flexible modes. Then, a method for the in-flight identification of the free-free frequency is presented, based on Fourier analysis of the telemetry signal, in spite of a low TM frequency.

Author (ESA)

N76-28323 British Aircraft Corp. (Operating) Ltd., Bristol (England).

THREE AXIS CONTROL OF SPACECRAFT WITH LARGE FLEXIBLE APPENDAGES

R. S. Harris and D. C. Todman *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 p refs (For availability see N76-28297 19-18)

(Contract ESTEC-2312/74-AK)

The applicability of control laws, derived for a completely rigid structure, to a three axis stabilized spacecraft with two large flexible appendages is examined. Three actuator devices are considered, being thrusters, DGMW (double gimbaled momentum wheel) and reaction wheels. For the configuration studied, it is demonstrated that the reaction wheel system is more susceptible to the effects of flexure. Control laws taking flexure into account are then designed for this system using both the classical approach (compensation networks) and modern techniques (observers with multivariable feedback). It is shown that the observer-based method produces a control scheme which maintains tight attitude control, is insensitive to realistic uncertainties in the system parameters and produces only a small array tip motion. Author (ESA)

N76-28324 Salford Univ. (England). Dept. of Aeronautical and Mechanical Engineering.

SYNTHESIS OF ACTIVE ON-BOARD CONTROLLERS FOR VIBRATORY SYSTEMS WITH RIGID BODY-MODES

B. Porter and A. Bradshaw *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 6 p refs (For availability see N76-28297 19-18)

A general method for the design of active on-board controllers for linear vibratory systems with rigid-body modes is illustrated by synthesizing an active vibration controller for a simple dynamical system consisting of flexible appendages and actuator-reaction inertias attached to a rigid center-body. Typical results of digital computer simulation studies are presented in order to illustrate the time-domain behavior of the controlled system. Author (ESA)

N76-28325 Hawker Siddeley Dynamics Ltd., Stevenage (England).

THE EFFECT OF FLEXIBILITY ON A CONTROL SYSTEM DESIGN FOR A RANGE OF SPACECRAFT AND HYBRID ARRAY CONFIGURATIONS

L. Flook and M. Burton *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 p (For availability see N76-28297 19-18)

The effect of large flexible solar arrays on a control system design for high power geostationary spacecraft is examined. The first anti-symmetric unconstrained bending mode and the first unconstrained twisting mode are determined for several configurations. The limit cycle frequencies in the roll and yaw axes during station keeping are derived. It is shown that control loop designs can be proposed for which the limit cycle frequency remains well below the first anti-symmetric unconstrained bending mode. The effect of the first twisting mode upon the pitch axis is examined by means of analog simulation. Although some disturbance of the main body occurs in all cases, the level may be reduced to a negligible one by a suitable choice of array drive loop parameters. It is suggested that careful design should enable any potential problems due to flexibility to be avoided for arrays of up to 4.5 kW. Author (ESA)

N76-28326 Departement d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).

SYNTHESIS OF FLEXIBLE SPACECRAFT COMMAND SYSTEMS [SYNTHESE DU SYSTEME DE COMMANDE DES ENGINS A MODE SOUPLE]

J. F. LeMaitre, J. P. Chretien, J. P. Jung, P. Rodrigo, and C. Reboulet *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 p refs In FRENCH; ENGLISH summary (For availability see N76-28297 19-18)

The attitude control of spacecraft with weakly damped modes was studied. A canonical form of the transfer function is found which controls launchers under the effect of propellant sloshing. General results are given for both continuous and digital control. Two types of controllers are considered, neglecting or not the knowledge of the natural frequencies of the system. The stability, the trade-off between good attitude control and good damping of the modes and the influence of the sampling period are investigated. Author (ESA)

N76-28327 Communications Research Centre, Ottawa (Ontario).

GROUND-TEST DERIVED AND FLIGHT VALUES OF DAMPING FOR A FLEXIBLE SPACECRAFT

F. R. Vigneron *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 9 p refs (For availability see N76-28297 19-18)

A method and approximate formula are outlined by which structural modal data, and in particular damping information, might be extrapolated from the one-g ground test state to the zero-g on-orbit state. Natural frequencies for the Communications Technology Satellite (CTS), as calculated using a model confirmed via ground test data, are in reasonable agreement with flight measured values. A limited amount of CTS data on the first-order symmetric modes shows that methods proposed for deduction of estimates of damping factors from ground-test data yield low but reasonable values. Estimates of damping factors are shown to be dependent on the model (viscous, structural) chosen to describe the damping mechanisms. Author (ESA)

N76-28328 Toronto Univ. (Ontario). Inst. for Aerospace Studies.

DEPLOYMENT DYNAMICS OF THE COMMUNICATIONS TECHNOLOGY SATELLITE Progress Report

P. C. Hughes *In* ESA Dyn. and Control of Non-rigid Space vehicles 1976 6 p refs (For availability see N76-28297 19-18)

A general deployment dynamics analysis is given in which N flexible appendages deploy in a (nominally) rectilinear fashion from a rigid primary body. The formulation is then applied to the Communications Technology Satellite for which a number of reasonable simplifying assumptions are made. The possibility is discussed of employing natural modes of the solar arrays corresponding to the instantaneous array length, and then the development of a set of ordinary differential equations based on these modes is sketched. Plans are described for comparing flight data with the model. Author (ESA)

N76-28329 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.

DYNAMIC STABILITY OF SATELLITES WITH LIQUID PROPELLANTS: RESULTS FOR SYMPHONIE AND APPLICATION TO OTHER SATELLITES

R. Metzger *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 7 p refs (For availability see N76-28297 19-18)

A number of theoretical investigations were carried out to demonstrate the attitude stability of Symphonie in the geostationary transfer orbit. During this phase of the mission the spacecraft is spin-stabilized, and nearly one half of its mass is the liquid propellants in the tanks of the apogee boost system. Stability limits and nutation time damping constants were obtained from these calculations. The theoretical results were confirmed by the excellent performance of both flight models. The results can be applied to other satellite configurations with liquid propellants. Author (ESA)

N76-28330 European Space Research and Technology Center, Noordwijk (Netherlands).

DYNAMICS OF TETHERED SATELLITES

P. Kulla *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 5 p refs (For availability see N76-28297 19-18)

It has been proposed to connect satellites to the orbiting Spacelab by tethers. The dynamics of this system are described by non-linear partial differential equations. The boundary conditions are time dependent due to variable tether length. This problem is overcome by a proper coordinate transformation. The resulting partial differential equations are transformed to difference equations, and these are integrated numerically. A control system is included which damps tether oscillations by variation of tether length. The results confirm that the concept is in principle feasible. There are, however, some clear performance restrictions from the system dynamics. Author (ESA)

N76-28332 European Space Research and Technology Center, Noordwijk (Netherlands).

DESIGN FEATURES AND ZERO GRAVITY SIMULATION OF THE GEOS SATELLITE LONG RADIAL BOOM RELEASE

G. L. Bring and W. W. Dorsey *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 9 p refs (For availability see N76-28297 19-18)

The selected design for the energy dissipative devices incorporated in the release mechanism for the long radial booms of the GEOS satellite is presented. The evaluation of the release dynamics has been made as a full scale experimental zero gravity test simulation. The essential satellite hardware has been used. The evaluated mass, center of gravity and moment of inertia of the boom sensor has been incorporated in the simulated experiment. The experiment moves on a smooth spin table on mass balanced, pivoted wheels. Gas drag is reduced by helium environment. The evaluation of the dynamics is made from slow motion film taken by a camera fixed relative to the rotating spin table. The reference grid is contained in the release plane, rotating with the satellite. The test set-up and the test results are presented. Some notes are made on computer simulations of the release. Author (ESA)

N76-28331 Spar Aerospace Products Ltd., Toronto (Ontario).

EQUATIONS OF MOTION AND COMPUTATIONAL ASPECT OF THEIR SOLUTION FOR BODIES CONNECTED IN A TOPOLOGICAL CHAIN

Rajnish Kumar *In* ESA Dyn. and Control of Non-rigid Space Vehicles 1976 10 p refs (For availability see N76-28297 19-18)

(Contract SR-15.31053-5-3825)

The motion and attitude of many articulated space vehicles can be analyzed by treating them as systems of point-connected bodies. Considering joint flexibility, free play and friction, coriolis and centrifugal effects, the equations of motion for bodies connected in a topological chain have been presented in a form which renders to optimization of arithmetic operations required for their numerical solution. Minimization of the computational operations is essential to reduce the computing cost and to make the real time simulation of a system possible without sacrificing accuracy. Estimates of these operations have been obtained considering an arbitrary number of bodies. These estimates are based on an optimization process and represent an efficient use of computer time and memory. Furthermore, these estimates are helpful in establishing the required computer time for simulation purposes. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-28333*# Alabama Univ., Huntsville. Center for Environmental and Energy Studies.
INTEGRATED REAL TIME CONTAMINATION MONITOR IRTCM Final Report, 11 Mar. 1975 - 10 Mar. 1976
W. E. Luttges May 1976 56 p refs
(Contract NAS8-31174)
(NASA-CR-149946) Avail: NTIS HC $4.50 CSCL 22B

Engineering and design work was performed on a monitoring device for particulate and gas contamination to be used in the space shuttle cargo area during launch at altitudes up to 50 km and during return phases of the flight. The gas sampling device consists of ampules filled with specific absorber materials which are opened and/or sealed at preprogrammed intervals. The design eliminates the use of valves which, according to experiments, are never sealing properly at hard vacuum. Methods of analysis including in-flight measuring possibilities are discussed. Author

N76-28334*# Gaertner Research, Inc., Stamford, Conn.
A STUDY OF DISCRETE CONTROL SIGNAL FAULT CONDITIONS IN THE SHUTTLE DPS Final Report
S. S. Reddi and C. T. Retter 30 Jun. 1976 116 p refs
(Contract NAS9-14703)
(NASA-CR-147827) Avail: NTIS HC $5.50 CSCL 14B

An analysis of the effects of discrete failures on the data processing subsystem is presented. A functional description of each discrete together with a list of software modules that use this discrete are included. A qualitative description of the consequences that may ensue due to discrete failures is given followed by a probabilistic reliability analysis of the data processing subsystem. Based on the investigation conducted, recommendations were made to improve the reliability of the subsystem. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-28335 Georgia Inst. of Tech., Atlanta.
THE EFFECT OF NOZZLE NONLINEARITIES ON THE NONLINEAR STABILITY OF LIQUID ROCKET MOTORS Ph.D. Thesis
Mysore Srikantiah Padmanabhan 1975 114 p
Avail: Univ. Microfilms Order No. 76-15556

The behavior of finite-amplitude waves inside the subsonic portion of a choked, axisymmetric nozzle was investigated with the objective of determining the nonlinear admittance at the nozzle entrance. The nonlinear conservation equations describing the wave motion inside the nozzle are solved using the Galerkin method and the resulting solutions are used to obtain a nonlinear nozzle admittance relation. This nonlinear nozzle admittance relation is used to analyze the nonlinear combustion instability in a cylindrical combustor with uniform injection of propellants at one end and a slowly converging nozzle at the other end. The Galerkin method is also used to determine the behavior of pressure perturbations in the rocket combustor. In these computations, a three-mode series expansion consisting of the first tangential, the second tangential and the first radial modes is used. Dissert. Abstr.

N76-28336*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
STUDY OF CRYOGENIC PROPELLANT SYSTEMS FOR LOADING THE SPACE SHUTTLE. PART 2: HYDROGEN SYSTEMS Final Report
W. G. Steward Oct. 1975 63 p refs
(NASA Order CC-37171-A)
(NASA-CR-148508; NBSIR-75-820) Avail: NTIS HC $4.50 CSCL 21H

Computer simulation studies of liquid hydrogen fill and vent systems for the space shuttle are studied. The computer programs calculate maximum and minimum permissible flow rates during cooldown as limited by thermal stress considerations, fill line cooldown time, pressure drop, flow rates, vapor content, vent line pressure drop and vent line discharge temperature. The input data for these programs are selected through graphic displays which schematically depict the part of the system being analyzed. The computed output is also displayed in the form of printed messages and graphs. Digital readouts of graph coordinates may also be obtained. Procedures are given for operation of the graphic display unit and the associated minicomputer and timesharing computer. Author

N76-28337*# General Dynamics/Convair, San Diego, Calif.
TC-2 POST HELIOS EXPERIMENT DATA REVIEW
31 Oct. 1975 298 p
(NASA-CR-148459) Avail: NTIS HC $9.25 CSCL 21H

Data are presented from a systems postflight analysis of the Centaur Launch Vehicle and Helios. Also given is a comparison of data from preflight analyses. Topics examined are: (1) propellant behavior; (2) helium usage; (3) propellant tank pressurization; (4) propellant tank thermodynamics; (5) component heating; thermal control; and thermal protection system; (6) main engine system; (7) H_2O_2 consumption; (8) boost pump post-meco performance; and (9) an overview of other systems. J.R.T.

N76-28338*# Rocket Research Corp., Redmond, Wash.
MARINER JUPITER/SATURN LCSSE THRUSTER/VALVE ASSEMBLY AND INJECTION PROPULSION UNIT ROCKET ENGINE ASSEMBLIES: 0.2-lbf T/VA DEVELOPMENT AND MARGIN LIMIT TEST REPORT Final Report
E. C. Clark 12 Dec. 1975 215 p Prepared for JPL
(Contract NAS7-100; JPL-954108)
(NASA-CR-148542; RRC-76-R-499) Avail: NTIS CSCL 21H

Thruster valve assemblies (T/VA's) were subjected to the development test program for the combined JPL Low-Cost Standardized Spacecraft Equipment (LCSSE) and Mariner Jupiter/Saturn '77 spacecraft (MJS) programs. The development test program was designed to achieve the following program goals: (1) demonstrate T/VA design compliance with JPL Specifications, (2) to conduct a complete performance Cf map of the T/VA over the full operating range of environment, (3) demonstrate T/VA life capability and characteristics of life margin for steady-state limit cycle and momentum wheel desaturation duty cycles, (4) verification of structural design capability, and (5) generate a computerized performance model capable of predicting T/VA operation over pressures ranging from 420 to 70 psia, propellant temperatures ranging from 140 F to 40 F, pulse widths of 0.008 to steady-state operation with unlimited duty cycle capability, and finally predict the transient performance associated with reactor heatup during any given duty cycle, start temperature, feed pressure, and propellant temperature conditions. Author

N76-28339*# Rocket Research Corp., Redmond, Wash.
MARINER JUPITER/SATURN LCSSE THRUSTER/VALVE ASSEMBLY AND INJECTION PROPULSION UNIT ROCKET ENGINE ASSEMBLIES: 0.2-lbf T/VA DEVELOPMENT AND MARGIN LIMIT TEST REPORT, ADDENDUM Final Report
W. W. Wilson 19 Mar. 1976 54 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954108)
(NASA-CR-148543; RRC-76-R-499-Add) Avail: NTIS HC $4.50 CSCL 21H

Capillary tube plugging phenomena on the 0.2-lbf thruster/valve assembly was examined. Vibration tests were conducted in the nozzle up attitude. Failure to fire caused by blockage of the capillary tube by catalyst fines was observed after vibration. Water flushing and previbration hot firing were used to remove the fines. J.M.S.

N76-28340*# McDonnell-Douglas Astronautics Co., Houston, Tex.
SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT. ORBITER TO SPACELAB ELECTRICAL POWER INTERFACE. AVIONICS SYSTEM ENGINEERING
T. E. Emmons 30 Jun. 1976 29 p
(Contract NAS9-14960)
(NASA-CR-147834; Rept-1.3-DN-C0504-036) Avail: NTIS HC $4.00 CSCL 22B

The results are presented of an investigation of the factors which affect the determination of Spacelab (S/L) minimum interface main dc voltage and available power from the orbiter. The dedicated fuel cell mode of powering the S/L is examined along with the minimum S/L interface voltage and available power using the predicted fuel cell power plant performance curves. The values obtained are slightly lower than current estimates and represent a more marginal operating condition than previously estimated. Author

N76-28341*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
CUSPED MAGNETIC FIELD MERCURY ION THRUSTER Ph.D. Thesis
John R. Beattie Jul. 1976 109 p refs
(Grant NGR-06-002-112)
(NASA-CR-135047) Avail: NTIS HC $5.50 CSCL 21C

The importance of a uniform current density profile in the exhaust beam of an electrostatic ion thruster is discussed in terms of thrust level and accelerator system lifetime. A residence time approach is used to explain the nonuniform beam current density profile of the divergent magnetic field thruster. Mathematical expressions are derived which relate the thruster discharge power loss, propellant utilization, and double to single ion density ratio to the geometry and plasma properties of the discharge chamber. These relationships are applied to a cylindrical discharge chamber model of the thruster. Experimental results are presented for a wide range of the discharge chamber length. The thruster designed for this investigation was operated with a cusped magnetic field as well as a divergent field geometry, and the cusped field geometry is shown to be superior from the standpoint of beam profile uniformity, performance, and double ion population. Author

N76-28342# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
EFFECTS OF STRUCTURAL FLEXIBILITY ON A REACTION JET SATELLITE ATTITUDE CONTROL SYSTEM
Gunter Malich Dec. 1975 63 p refs
(UTIAS-TN-199) Avail: NTIS HC $4.50

The performance of a satellite reaction jet attitude control system can be severely degraded by structural flexibility. Using a computer-modelled spacecraft with a pseudo-rate controller, a quantification of the performance loss is presented. Flexibility is introduced into the simulation in a very general way by reducing elastic interaction to a series of modal frequency and gain parameters. The modelled system is found to remain stable under all conditions studied, although performance may suffer various degrees of degradation. Author

N76-28343# European Space Agency, Paris (France).
PAYLOAD TRANSFER SYSTEMS BASED ON CHEMICAL ROCKET PROPULSION INCLUDING ATTITUDE CONTROL AND ORBIT CORRECTION: APPLICATION, ANALYSES, CONCEPTS
Dec. 1975 254 p refs Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur: Anwend., Anal., Konzepte', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 353 p Proc. of the DGLR Chem. Propulsion Systems Comm. Meeting, Stuttgart, 12-13 Feb. 1974 Original German report available from DFVLR, Porz, West Ger. DM 129.60
(ESA-TT-213; DLR-Mitt-74-34) Avail: NTIS HC $9.00

Possible chemical kickstage and apogee motor configurations and propellant combinations for transferring payloads into stationary orbits are surveyed and discussed. Nuclear propulsion systems are also dealt with. Thrust units for satellite attitude and orbit control, based on hydrazine and gaseous hydrogens/gaseous oxygen are analyzed. For individual titles, see N76-28344 through N76-28358.

N76-28344 European Space Agency, Paris (France).
TECHNOLOGY OF A SYSTEMS ANALYSIS OF CHEMICAL PROPULSION MODULES
D. Manski, J. Broschk, M. Bunn et al *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 11-32 refs Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 11-32 (For availability see N76-28343 19-20)

A payload transfer stage based on chemical propellants for a wide variety of transfer missions was investigated. The system is a payload on an L-3-S carrier rocket. No limit is assumed in the number of parameters to be considered. All considerations of propellants, liquid, hybrid, or tribrid, were taken into account, excepting solid fuels. A systematic variation was made of alternative design principles, thrust levels, number of propulsion units, tank configurations, pressure gas systems, mission durations, pressure gas media, cooling systems, and takeoff masses, and their effect on the system was studied. ESA

N76-28345 European Space Agency, Paris (France).
TRENDS AND RESULTS OF A SYSTEMATIC ANALYSIS OF CHEMICAL PROPULSION MODULES
J. Broschk, D. Manski, and M. Bunn *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 33-52 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 33-52 (For availability see N76-28343 19-20)

Various possible kickstage configurations and high energy fuels for payload transfer from an earth orbit into a geostationary orbit were compared based on technical criteria, particularly payload capacity. Political and cost criteria were not considered. Comparison of the structural designs for kickstages shows that there are no significant differences as regards performance. Comparison of combination of high energy fuel shows that LH2 combinations are unsuitable since they cannot easily be used for missions of protracted duration. In view of space storability it is felt that fluorine/hydrazine is the preferred combination. ESA

N76-28346 European Space Agency, Paris (France).
SOLID FUEL PROPULSION UNITS FOR APOGEE MOTORS AND KICKSTAGES
H. Selzer *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 53-68 refs Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 53-68 (For availability see N76-28343 19-20)

A comparison was made of the structural weights of solid propellant engines for apogee motors and kickstages. It is shown that a propulsion system cannot be assessed from the point of view of weight only. The use of solid fuel propulsion units has proved that they have many advantages for certain missions and, indeed, in the case of perigee and apogee stages they can increase the payload compared with medium energy liquid fuel systems. ESA

N76-28347 European Space Agency, Paris (France).
A FLEXIBLE PAYLOAD TRANSFER SYSTEM WITH SOLID FUEL PROPULSION
E. Hau *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 69-80 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 69-80 (For availability see N76-28343 19-20)

A transfer system based on solid fuel motors is outlined based on the American kickstage project OVI-B. This system has two main factors: interchangeable solid fuel motors of varying

sizes, and separable jettisonable equipment and control module. Its application to the transfer of synchronous satellites with the Ariane rocket launcher is considered. It could be produced with a minimum of expenditure on development. ESA

N76-28348 European Space Agency, Paris (France).
STANDARD APOGEE MOTORS FOR SATELLITES WITH A PROPULSIVE CHARGE OF 300 TO 900 KG AS FRONT BURNERS WITH RAPIDLY BURNING PS870 COMPOSITION
K. H. Hoock *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 81-94 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 81-94 (For availability see N76-28343 19-20)

The development of a flexible solid fuel apogee motor for geostationary satellite missions is described. This motor is shown to have advantages over a liquid fuel system by virtue of its lesser complexity. Large savings in development costs may be achieved by producing a standard apogee motor equipped with a PS 870 silicone rubber composition front burner propulsive charge which can be adapted for specific projects by altering the burn-up speed and lengthening the cylindrical part of the combustion chamber. Equipment used for manufacturing the propulsion units and the propulsive charges can be used for all designs since only the cylindrical part of the combustion chamber has to be varied. ESA

N76-28349 European Space Agency, Paris (France).
THE CONCEPT OF A UNIVERSALLY EMPLOYABLE PROPULSION MODULE. PART 1: APPLICATIONS AND DEFINITION OF PROPULSION MODULE. PART 2: PERFORMANCE ANALYSIS
K. Bohnhoff *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 95-132 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 95-132 (For availability see N76-28343 19-20)

A survey of satellite propulsion system applications, missions, and types is presented. A performance analysis is given of launcher and module for geostationary missions, shuttle missions, interplanetary fly-by missions, and planetary orbiter missions. ESA

N76-28350 European Space Agency, Paris (France).
PROPELLANT CHOICE AND PROPULSION SYSTEM CONCEPTS FOR INDEPENDENT TRANSFER PROPULSION MODULES
A. Seidel *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 133-151 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 133-151 (For availability see N76-28343 19-20)

An investigation of the fuel combination best suited for a transfer propulsion module was carried out. A preliminary choice was made, and the effective specific impulse in vacuum was determined. The probable effective impulse was obtained from the theoretical impulse for equilibrium flow, due allowance being made for various losses. All effective specific impulses in vacuum are represented as a function of the mixture ratio. Possible propulsion module configurations using the fuel combination selected are described. ESA

N76-28351 European Space Agency, Paris (France).
THE HYBRID TUG: AN ALTERNATIVE CONCEPT FOR THE SPACE TUG
H. O. Ruppe, W. M. Schauer, and R. H. Schmucker *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 153-202 refs Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 153-202 (For availability see N76-28343 19-20)

The possibility of using an expendable space tug for the space shuttle was investigated. Selection criteria were developed for various space tug propulsion systems, and the systems were examined and compared based on these criteria. Results of these investigations show that a space tug with hybrid propulsion fulfills the requirement very well. ESA

N76-28352 European Space Agency, Paris (France).
THE POTENTIAL PAYLOAD CAPACITY OF THE L-3-S LAUNCHER, USING VARIOUS TRANSFER PROPULSION SYSTEMS
J. Wedel *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 203-230 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 203-230 (For availability see N76-28343 19-20)

Various orbit computations were carried out for the L-3-S (Ariane) launcher system to check previously provided design data and to obtain the orbit data necessary for the design of the intermediate structures. As work proceeded, the following influences were also investigated: effect of vertical ascent time on separation height and payload, effect of the position of the separation plane in the intermediate structure between the 1st and 2nd stages on the payload, and effect of the pre-acceleration rockets on the payload. The payload capacity of the two-stage L35/ H6 in low orbit was also ascertained (test flight of L-3-S 2nd and 3rd stages). The payload capacity of the L-3-S, using various upper stages, was subsequently investigated and a closer examination made of a future transfer system (radio-isotope propulsion). Author (ESA)

N76-28353 European Space Agency, Paris (France).
POTENTIAL CAPABILITIES AND LIMITS OF NUCLEAR-THERMAL ROCKET PROPULSION FOR USE WITH PAYLOAD TRANSFER SYSTEMS
D. Borchardt *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 231-263 Transl. into ENGLISH of "Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 231-263 (For availability see N76-28343 19-20)

European and American work in the field of thermonuclear propulsion for payload transfer systems is reviewed. The European developments for the Europa 3 launch vehicle and the American developments for NERVA are outlined. The efficiency of thermonuclear propulsion is considered. Indications are given for future development. ESA

N76-28354 European Space Agency, Paris (France).
REQUIREMENT ANALYSIS FOR ORBIT CORRECTION AND ATTITUDE CONTROL THRUST UNITS
W. Wolfsberger, J. Herzog et al *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 269-293 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 269-293 (For availability see N76-28343 19-20)

The causes of satellite orbit and attitude changes are outlined, and satellite and probe missions summarized, in order to determine future requirements for orbit and attitude control thrust units. The basic principles of mission analysis are described, and resulting relevant data for thrust unit assessment are presented. Different thrust systems are compared, and their requirements are assessed. ESA

N76-28355 European Space Agency, Paris (France).
PRESENT STATE OF DEVELOPMENT AND USE OF CATALYTIC AND ELECTROTHERMAL HYDRAZINE THRUST UNITS FOR THE ORBIT AND ATTITUDE CONTROL OF SATELLITES
H. D. Schmitz *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction

(ESA-TT-213) Dec. 1975 p 294-315 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 294-315 (For availability see N76-28343 19-20)

European development of catalytic and electrothermal thrust units for satellite orbit and attitude control is summarized. Prospects for the use of hydrazine propulsion units in Europe, and for future developments in the field of hydrazine technology, are outlined. ESA

N76-28356 European Space Agency, Paris (France).
RESEARCH INTO ATTITUDE CONTROL THRUST UNITS FROM THE POINT OF VIEW OF POSSIBLE TECHNICAL APPLICATIONS: CH2/GO2 THRUST SYSTEMS FOR ORBIT CORRECTION AND ATTITUDE CONTROL
H. Warntjes, W. Wendekamm et al *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 316-330 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 316-330 (For availability see N76-28343 19-20)

Investigations of hot-gas thrust units for satellite attitude control and orbit correction are reported. The thrust units make use of high energy fuel combinations which are fed into the combustion chamber in a gaseous state. The CH2/GO2 electrolytic monergolic hot-gas and the CH2/ GO2 electrolytic hot/cold gas systems are shown to produce total impulses exceeding 10,000 Ns. A weight analysis was also carried out. ESA

N76-28357 European Space Agency, Paris (France).
THERMAL HYDRAZINE DECOMPOSITION. RESEARCH WORK NECESSARY TO SUPPLEMENT THE PRESENT STATE OF TECHNOLOGY
H. Twardy *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 331-340 Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 331-340 (For availability see N76-28343 19-20)

A review is given of the increased possible applications of thermal decomposition for thrust-producing purposes. Small thrusters based on catalytic hydrazine decomposition for satellite attitude and orbit control are limited by catalyst properties. Noncatalytic hydrazine decomposition was studied for thrust units below 150 mN. The additional research and development work necessary in the field of hydrazine thermal decomposition is discussed. ESA

N76-28358 European Space Agency, Paris (France).
A NEW INVESTIGATION WITH HYDRAZINE CATALYSTS
H. Selzer *In its* Payload Transfer Systems Based on Chem. Rocket Propulsion Including Attitude Control and Orbit Correction (ESA-TT-213) Dec. 1975 p 341-350 refs Transl. into ENGLISH of 'Nutzlasttransfersysteme auf Basis chem. Raketenantriebe einschliesslich Lageregelung u. Bahnkorrektur', DGLR, Cologne Report DLR-Mitt-74-34, 15 Nov. 1974 p 341-350 (For availability see N76-28343 19-20)

Based on experience with Shell 405 catalyst for hydrazine decomposition in satellite attitude and orbit control thrust units, the need for improvements of the catalyst are given. Possible methods for investigations as a basis for these improvements are reviewed. ESA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-28359 Nevada Univ., Reno.
REACTIONS OF THE NICKEL TRIAD WITH ORGANOPHOSPHORUS LIGANDS Ph.D. Thesis
Allen William Verstuyft 1976 358 p
Avail: Univ. Microfilms Order No. 76-16487

The reactions of the zerovalent and divalent nickel triad metals with organophosphorus ligands were studied. The products of these reactions were isolated and characterized by melting point, gas chromatography, and nuclear magnetic resonance spectroscopy (nmr). From these reactions and their products, a proposed mechanism for coupling reactions was formulated. Reactions of acetylenes with the zerovalent palladium complexes were studied. Only terminal acetylenes reacted with these complexes to yield the air-stable colorless crystalline trans-(R3P) 2Pd(C=CR)2. The complexes were characterized by elemental analyses, chemical reactions, and spectroscopic methods. Mechanistic implications are presented and discussed in relation to similar reactions with zerovalent homogeneous platinum complexes. Dissert. Abstr.

24 COMPOSITE MATERIALS

Includes laminates.

N76-28360 Vanderbilt Univ., Nashville, Tenn.
INVESTIGATION OF THE EFFECTIVE THERMAL CONDUCTIVITY OF GAS-FILLED FIBER-POWDER INSULATION SYSTEMS FOR RESIDENTIAL AND COMMERCIAL STRUCTURES Ph. D. Thesis
Decatur Braxton Rogers 1976 193 p
Avail: Univ. Microfilms Order No. 76-15504

The steady state heat flux into a residential or commercial structure is related to the effective thermal conductivity of the insulation material and the temperature gradient. This investigation was specifically instituted for development of an insulation having transmittance in the range of 0.008 to 0.02 Btu/hr sq ft - F which could be used in residential and commercial buildings. This corresponds to an order of magnitude better than existing insulation. The system developed which meets the transmittance criteria is a gas-filled fibrous insulation seeded with powder. Thus, a primary objective of this research was to obtain experimental data which permit the determination of the effective mean thermal conductivities of gas-filled fiber powder systems. Selected gas-filled fiber-powder systems were measured as functions of density, powder particle size, insulation thickness, and temperature under steady state conditions. Dissert. Abstr.

N76-28361 California Univ., Berkeley.
FATIGUE AND FRACTURE OF HIGH STRENGTH FILAMENTS Ph.D. Thesis
Neil Lawrence Holt 1975 108 p
Avail: Univ. Microfilms Order No. 76-15074

Current theories for both the static and fatigue strength of filamentary materials are reviewed. An analysis of static strength tests on short filaments is presented that explains seemingly anomalous test behavior which was reported. The proposed approach is supported by experiments and computer analysis. A new machine for the fatigue testing of filaments or wires was designed and is described. Results are presented for fatigue tests on tungsten wire, graphite filaments, and glass filaments. Graphite filaments showed an unexpected deterioration in strength after very many cycles. An explanation of this effect is offered and supported by scanning electron microscope observations. Dissert. Abstr.

N76-28362 Minnesota Univ., Minneapolis.
ELASTIC AND DISSIPATIVE PROPERTIES OF FIBER REINFORCED COMPOSITE MATERIALS IN FLEXURAL VIBRATION Ph.D. Thesis
Ronald Franklin Gibson 1975 203 p
Avail: Univ. Microfilms Order No. 76-14892

The shock and vibration response of any structure is governed by the elastic stiffness and the internal damping of its constituent materials. The results are presented of an analytical and experimental effort to find the internal damping and the elastic stiffness of typical fiber-reinforced composite structural materials under flexural vibration. The variables considered were material configuration, vibration frequency, and vibration amplitude. The effects of material configuration and vibration frequency were studied analytically and experimentally for small amplitudes. The

effects of large amplitudes and resulting structural damage in the materials were found experimentally. Dissert. Abstr.

N76-28363 Case Western Reserve Univ., Cleveland, Ohio.
AN ANALYTIC METHOD FOR PREDICTING THE FLOW AND FRACTURE IN NOTCHED FIBER COMPOSITE MATERIALS Ph.D. Thesis
Paul Lloyd Flynn 1975 127 p
Avail: Univ. Microfilms Order No. 76-16042

An analytical system was developed for the prediction of the onset and progress of plastic flow, and for the fracture of, oriented fiber composite materials in which both externally applied complex stress states (both biaxial and triaxial) and stress raisers were present. The accuracy of the analytical system was demonstrated by the agreement between analytically predicted and experimentally measured flow values of externally notched tungsten-wire reinforced copper composites, in which the fiber fraction was 50% by volume. The predictive system was a unique combination of two numerical analysis systems, the SAAS 2 finite element system and a micromechanics finite element program. The SAAS 2 system was used to generate three dimensional stress distributions in the axially loaded notched composites; these distributions were then used as the input into the micromechanics finite element program. Dissert. Abstr.

N76-28364 Notre Dame Univ., Ind.
EFFECT OF CO-60 GAMMA IRRADIATION ON METAL-CERAMIC SYSTEMS Ph.D. Thesis
Antoni Jan Klimasara 1976 201 p
Avail: Univ. Microfilms Order No. 76-16496

Studies were performed to determine the effect of Co-60 gamma irradiation upon metal-ceramic systems. The following systems were studied: silver supported catalysts, silver powders, sandwich type samples (Ag/Ca(OH)2/Ag), calcium hydroxide, calcium carbonate, and a silver galvanic cell. The following experimental methods were used: ethylene oxidation experimental set-up, ESCA and AES, experimental set-up to study gas products from radiation decomposition, X-ray diffraction method, SEM, BET surface measurements, and measurements of current in a silver galvanic cell. It is suggested that observed Co-60 gamma ray effects on metal ceramic systems are electrochemical in nature and can be explained by radiation chemistry. Dissert. Abstr.

N76-28365# Polish Academy of Sciences, Warsaw.
QUASI-EQUALIZED MOVEMENT OF AN ELASTIC DIELECTRIC [QUASI-ZROWNOWAZONY RUCH SPREZYSTEGO DIELEKTRYKA]
Kazimierz Reginski 16 Oct. 1975 18 p refs In POLISH
Avail: NTIS HC $3.50

A method of linearization is used to solve dynamic problems of a nonlinear theory of electroelasticity. The starting point of the considerations is the well known idea of quasi-equalized movement, which is utilized in describing the movement of an elastic dielectric subjected to great deformation. It is established that in the case of small velocities and accelerations of movement of the medium, solutions of equations of electroelasticity can be written in the form of a superposition of solutions corresponding to movement quasi-equalized with the field of small additional polarization dependent on time. The method presented can be utilized to solve the problem of harmonic movement with low frequency and large amplitude vibrations.
Author

N76-28366# Polish Academy of Sciences, Warsaw.
POLYVINYLOCARBASOL, NEW MATERIAL FOR THE ELECTRONIC INDUSTRY [POLIWINYLOKARBAZOL NOWOCZESNY MATERIAL DLA PRZEMYSLU ELEKTRONICZNEGO]
Jan Pielichowski, F. Starzyk, J. Ranachowski, and V. A. Kunert 6 Oct. 1975 16 p refs In POLISH
Avail: NTIS HC $3.50

The peculiarities of the polymer polyvinylcarbasol and its derivatives, as well as its potential applications, were described. This material is resistant to chemical action and corrosion, has great physical endurance, withstands a wide range of temperatures, and may easily be worked to any shape. It may be used as an excellent dielectric, as a construction material, or as a photosensitive material. It may be obtained by classical polymerization methods and by use of polymerization with luminescent discharge.
Author

N76-28367*# Los Alamos Scientific Lab., N.Mex.
CARBIDE COATED FIBERS IN GRAPHITES-ALUMINUM COMPOSITES Final Progress Report, 1 Jan. - 30 Jun. 1975
Richard J. Imprescia, Leonard S. Levinson, Robert D. Reiswig, Terry C. Wallace, and Joel M. Williams Washington NASA Jul. 1976 43 p refs
(NASA Order L-75900)
(NASA-CR-2711; LA-6181-PR; PR-4) Avail: NTIS HC $4.00 CSCL 11D

Research activities are described for a NASA-supported program at the Los Alamos Scientific Laboratory to develop graphite fiber-aluminum matrix composites. A chemical vapor deposition apparatus was constructed for continuously coating graphite fibers with TiC. As much as 150 meters of continuously coated fibers were produced. Deposition temperatures were varied from 1365 K to about 1750 K, and deposition time from 6 to 150 seconds. The 6 sec deposition time corresponded to a fiber feed rate of 2.54 m/min through the coater. Thin, uniform, adherent TiC coats, with thicknesses up to approximately 0.1 micrometer were produced on the individual fibers of Thornel 50 graphite yarns without affecting fiber strength. Although coat properties were fairly uniform throughout a given batch, more work is needed to improve the batch-to-batch reproducibility. Samples of TiC-coated Thornel 50 fibers were infiltrated with an aluminum alloy and hot-pressed in vacuum to produce small composite bars for flexure testing. Strengths as high as 90% of the rule-of-mixtures strength were achieved. Results of the examination of the fracture surfaces indicate that the bonding between the aluminum and the TiC-coated fibers is better than that achieved in a similar, commercially infiltrated material made with fibers having no observable surface coats. Several samples of Al-infiltrated, TiC-coated Thornel 50 graphite yarns, together with samples of the commercially infiltrated, uncoated fibers, were heated for 100 hours at temperatures near the alloy solidus. The TiC-coated samples appear to undergo less reaction than do the uncoated samples. Photomicrographs are shown.
Author

N76-28368*# Scientific Translation Service, Santa Barbara, Calif.
MEASUREMENT OF INTERNAL OXIDATION OF REACTION-BONDED SILICON NITRIDE DURING CREEP
W. Engel, F. Porz, and F. Thuemmler Washington NASA Aug. 1976 13 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (West Germany), v. 52, no. 9, 1975 p 296-299
(Contract NASw-2791)
(NASA-TT-F-17134) Avail: NTIS HC $3.50 CSCL 11D

Mean concentrations and concentration profiles of Si2ON and related substances were measured using X-ray diffraction while the samples were subjected to creep loads.
Author

N76-28369*# Scientific Translation Service, Santa Barbara, Calif.
DURABILITY OF TUNGSTEN-COBALT CARBIDE ALLOYS
P. D. Shnyrev Washington NASA Jul. 1976 6 p refs Transl. into ENGLISH from Mashinovedeniye (USSR), no. 1, 1974 p 111-112
(Contract NAS7-100)
(NASA-TT-F-16745) Avail: NTIS HC $3.50 CSCL 11D

The relative durability of alloys with a differing content of cobalt and different average grain diameters of the tungsten was studied. In the former case, the cobalt content in the alloys changed from 4 to 20%. In the latter case, tests were conducted on alloys with 6% cobalt of very fine grained, fine, normal, and large grained series, with grain diameters of the carbide phase of 1.27, 2.0, 2.35 and 2.54 microns respectively. The wear was determined in the form of volumetric wear, and the relative durability was determined as the ratio of the standard wear magnitude to the wear of the sample being studied with the same friction methods.
Author

N76-28370*# Scientific Translation Service, Santa Barbara, Calif.
POSITRON ANNIHILATION AND STRUCTURE DEFECTS IN ARTIFICIAL GRAPHITE
V. I. Spitsyn, G. M. Bardenev, I. I. Bardyshev, A. I. Lutkov, and A. D. Tsyganov Washington NASA Jul. 1976 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow),

v. 225, no. 3, 1975 p 628-631
(Contract NASw-2791)
(NASA-TT-F-17120) Avail: NTIS HC $3.50 CSCL 11D

The positron annihilation method is used to study the nature of crystallographically disordered (amorphous) regions in pyrolitic graphite and to determine the effect of heat treatment on these structure defects. The method is based on the fact that positrons which penetrate the material will be annihilated upon coming in contact with the electrons from the outer orbitals of the crystalline material. The positron lifetime and characteristics of the gamma quanta emitted are determined by the states of the annihilated electrons. The electron will offer evidence about the graphite structure. Author

N76-28371*# Scientific Translation Service, Santa Barbara, Calif.
HOT PRESSING OF SILICON NITRIDE: ANALYSIS OF DENSIFICATION MECHANISMS
P. Vincenzini Washington NASA Aug. 1976 22 p refs Transl. into ENGLISH from Ceramurgia (Italy), vol. 5, no. 4, Oct.-Dec. 1975 p 184-188
(Contract NASw-2791)
(NASA-TT-F-17132) Avail: NTIS HC $3.50 CSCL 11D

The problems involved in the hot pressing of silicon nitride are reviewed with special reference to the manufacturing technique and to the thermodynamic and kinetics aspects of the sintering process. Probable mechanisms of densification, and the effect of additives and impurities on the process, are discussed. Author

N76-28372# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
DISTRIBUTION OF ANIONS AND THEIR ISOMERS IN FUSED SILICATES
O. A. Esin 1974 11 p refs Transl. into ENGLISH from "Elektrokhimiya i Rasplavy" Moscow, Nauka Press, 1974 p 207-214
(NRC/CNR-TT-1874; ISSN-0077-5606) Avail: NTIS HC $3.50

Equations describing the distribution of anions accounts for isomers, particularly the branched chains. The formulae for the distribution of branched chain anions were derived by Hess and Masson. To determine the distribution of multichains, the Bernoulli formula for the probability was used so that a given event will occur r times in m independent tests, if the probability of its occurrence in a single test is p. Author

N76-28373# Lockheed Missiles and Space Co., Palo Alto, Calif.
STATISTICAL THEORY OF CUMULATIVE DAMAGE IN COMPOSITE MATERIALS AND THE SCALE EFFECT OF RELIABILITY
V. V. Bolotin [1976] 11 p refs Transl. into ENGLISH from Mekh. Polim. (Latvian SSR), no. 2, 1976 p 247-255
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A statistical theory is developed for the rupture of oriented composite materials which is based on the com concdp concept of cumulative damage. Under the assumption that the density of the damage preceding the time of rupture is sufficiently small, asymptotic distributions are derived for the measure of damage as are also asymptotic expressions for the reliability function. The possibility is shown of an application of the theory to predict the reliability and scale effect in structures from oriented composite materials. Author

N76-28374# Naval Ship Research and Development Center, Annapolis, Md. Materials Dept.
ANTIFOULING GLASS-REINFORCED COMPOSITE MATERIALS Research and Development Report
J. A. Montemarano and S. A. Cohen Jan. 1976 27 p refs (ZF61512001)
(AD-A020153; MAT-75-33) Avail: NTIS CSCL 11/4

Various organometallic polyesters and epoxies were prepared by different synthetic methods. These novel plastics will be used to prepare antifouling glass-reinforced composites for marine structural applications such as use in seawater piping systems. An organometallic glass-reinforced polyester laminate was fabricated and showed a minimal reduction in structural properties when compared to a conventional polyester laminate. Two types of organometallic glass-reinforced epoxy laminates were prepared. One type showed only slight reduction in structural properties. Organometallic polymethacrylates and polyvinyls, previously synthesized, still exhibit 100% antifouling performance after 2 1/2 years of exposure at the Pearl Harbor Naval Shipyard. Author (GRA)

N76-28375# Battelle Pacific Northwest Labs., Richland, Wash.
LAMELLAR COMPOSITES FORMED BY SPUTTER DEPOSITION: PROPERTIES AND POTENTIAL APPLICATION TO TURBINE BLADES Annual Technical Report, 1 May 1974 - 30 Jun. 1975
R. A. Busch and J. W. Patten Jul. 1975 90 p refs
(Contract F44620-73-C-0071; ARPA Order 2482-2; AF Proj. 6813; AF Proj. 9782)
(AD-A020633; AFOSR-76-0013TR) Avail: NTIS CSCL 11/4

This report presents the results of the research done during the second year or Phase II of an investigation of the properties and behavior of lamellar composites formed by sputter deposition. Two approaches have been investigated in parallel in Phases I and II of the contract. Both were expected to result in yield strengths on the order of 1% or more of the modulus of the composite material. The thin-layered approach, with about 50 A thick layers, was expected to derive its strengthening from interface effects between layers and the small thickness of the layers. The compound-forming approach, with about 2,000 A thick layers, was expected to derive its strengthening from the bulk properties of the components and their reaction products. GRA

N76-28376# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE GALVANIC CORROSION OF GRAPHITE EPOXY COMPOSITE MATERIALS COUPLED WITH ALLOYS M.S. Thesis
Bennie A. Miller, Jr. Dec. 1975 99 p refs
(AD-A019322; GAE/MC/75D-8) Avail: NTIS CSCL 11/6

A controlled laboratory study was made of the galvanic corrosion that occurs when graphite-epoxy composite material (GECM) is coupled with various alloys in neutral 3.5% aqueous NaCl at room temperature. These tests simulated GECM/alloy joints that occur in aerospace applications. Previous work has shown that GECM acts as an extremely noble metal when coupled with a limited number of alloy types such as aluminum and titanium. This study extends this research by considering more alloy types; namely, steels, stainless steels, nickel base, copper, as well as aluminum and titanium. Four types of GECM were used along with pure graphite. Twenty-three alloys were tested for compatibility with GECM. Electrochemical test methods included potential measurements and galvanic current measurements. Galvanic current was measured by the use of a potentiostat modified to operate as a zero-resistance ammeter. Weight-loss tests were also conducted. GRA

N76-28377# Asphalt Inst., College Park, Md.
EVALUATION OF PROPERTIES OF ASPHALT CEMENTS WITH EMPHASIS ON CONSISTENCIES AT LOW TEMPERATURES Final Report
V. P. Puzinauskas Jan. 1967 57 p refs Presented at the Ann. Meeting of the Assoc. of Asphalt Paving Technologists, Denver, Colo., Feb. 1967
(PB-250508/9; RR-67-3) Avail: NTIS HC $4.50 CSCL 13C

The testing program described had several purposes. One was to develop suitable and significant tests to measure consistency of asphalt cements at temperatures encountered during pavement service. The second was to establish low-temperature limits in the proposed study specifications for asphalt cements, based on the developed test method. Finally, the verification of established viscosity limits at 140 and 275 F temperatures were considered as an additional aim of this testing program. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-28378 Missouri Univ., Rolla.
TOTAL SCATTERING CROSS SECTION MEASUREMENTS FOR ARGON ON WATER VAPOR OVER THE RELATIVE VELOCITY RANGE 650 TO 1100 METERS PER SECOND Ph.D. Thesis
Henry Eugene Berek, Jr. 1975 198 p
Avail: Univ. Microfilms Order No. 76-14613

Total scattering cross section measurements were made, using a dense well collimated neutral beam formed by a supersonic nozzle, and impinging upon a target gas contained at a known constant pressure in a scattering cell. Those beam particles that pass through the target cell without undergoing collisions are detected using an electron bombardment ionizer, mass spectrometer and electron multiplier. The attenuated beam intensity is recorded as a function of the target cell gas density. The effective scattering cross section is obtained from a non-linear least squares fit to an exponential attenuation formula. Total scattering cross sections are obtained by taking into account the Maxwellian velocity distribution of the target gas particles. A Lennard-Jones (12,6) potential has been chosen as a model and appropriate potential parameters calculated from the data using a least squares fitting technique. For the interaction of argon on water vapor they are: rm = 3.22 + or - .16 A, sigma = 2.87 + or - .14 A. Dissert. Abstr.

N76-28379 New York Univ., N.Y.
FLAME PROPAGATION THROUGH MONODISPERSE LIQUID FUEL SPRAYS Ph.D. Thesis
Venkataramiah Srinivas 1976 114 p
Avail: Univ. Microfilms Order No. 76-14605

Experimental studies on flame propagation in sprays of monosized droplets have shown that the droplet size exerts a strong influence on the burning characteristics of the spray. A theoretical model for flames propagating through such sprays is presented. The physical system considered is that of a spray of monosized droplets falling freely through air in a vertical tube. A propagation mechanism, based on the concept that the flame envelopes around burning droplets act as high temperature heat sources for the ignition of adjacent droplets, was employed. It was assumed that droplets in the spray are arranged in arrays. The flame in the wake of a sedimenting droplet was treated as a cylindrical jet of combustible gas burning in a uniform flow of air. The ignition of droplets was characterized by ignition time lag, which was calculated by using a semi-empirical method. The governing equations, with appropriate constraints, were solved numerically. Dissert Abstr.

N76-28380 Massachusetts Univ., Amherst.
THE DESIGN AND CONSTRUCTION OF TWO FLUORESCENCE DETECTION SYSTEMS AND THEIR APPLICATION IN AUTOMATIC CONSTANT CURRENT COULOMETRIC DETERMINATIONS Ph.D. Thesis
Gordon Eugene Cadwgan, Jr. 1976 171 p
Avail: Univ. Microfilms Order No. 76-14635

These systems possess PPB sensitivity and respond fast enough to keep pace with the rapid generation of titrant within the electrochemical cell. Determinations of very small amounts of material can thus be accomplished in a very short time period. Since a constant current is used throughout the determination, Faraday's Law can be used to calculate the number of equivalents generated within the cell. The first fluorescence detection system is a simple inexpensive single beam instrument which uses a tungsten halogen lamp as an excitation source and a simple filtering system to isolate an excitation band of energy. The fluorescence within a cell is detected with a photodiode and the current is converted to a voltage and amplified. This signal voltage is compared with a reference voltage using a comparator. Dissert. Abstr.

N76-28381 Kansas Univ., Lawrence.
APPEARANCE POTENTIALS OF SOME METAL DITHIOCARBAMATES USING A COMPUTER INTERFACED MASS SPECTROMETER Ph.D. Thesis
Vernon Omer Brandt 1975 159 p
Avail: Univ. Microfilms Order No. 76-16696

This study was undertaken to interface a general purpose mass spectrometer with a minicomputer for the measurement of appearance potentials and then to determine the substituent effect on the metal-sulfur bond in metal dithiocarbamates from these measurements. Appearance potential values can be used to calculate bond energies. The dithiocarbamates are an important class of compounds used to complex (b)-type metals. In measuring appearance potentials, the intensity of the ion of interest was recorded as a function of the electron energy. From the ionization efficiency curve obtained, several methods were used to determine the appearance potential. The ion intensity was digitized by two general types of analog-to-digital converters: (1) successive approximations converter and (2) voltage-to-frequency converter. The electron energy, which is controlled by a ten-turn potentiometer, was digitized by relating shaft position of the potentiometer to the chamber voltage. Dissert. Abstr.

N76-28382 Cornell Univ., Ithaca, N.Y.
COMPUTER-AIDED INTERPRETATION OF MASS SPECTRA: AN IMPROVED STIRS PROGRAM GIVING INFORMATION ON SUBSTRUCTURE PROBABILITIES Ph.D. Thesis
Henry Earl Dayringer 1976 172 p
Avail: Univ. Microfilms Order No. 76-15900

The Self-Training Interpretive and Retrieval System (STIRS), a computer program for aiding mass spectral interpretation, is used to provide quantitative information about the presence of specific substructures in unknowns. STIRS, which uses the spectral data in several different classes, selects the compounds from a reference file of nearly 19000 compounds which best match the unknown in mass spectral behavior in each of the several data classes and, by combination of these results, those compounds which most closely match the overall spectral behavior of the unknown. Computerized examination of the substructures common to the retrieved compounds and use of a model based on random drawing theory allows automatic calculation of the confidence that the STIRS results indicate the presence of a particular substructure in the unknown. Dissert. Abstr.

N76-28383 California Univ., Berkeley.
THE KINETICS OF THE REDUCTION OF NITRIC OXIDE BY TIN(2) Ph.D. Thesis
Dan Eldon Hendriksen 1975 95 p
Avail: Univ. Microfilms Order No. 76-15212

The kinetics of the reaction of nitric oxide with tin(II) in perchloric acid solution were studied using a vibratory stirrer to maintain gas-solution equilibrium. Products of the reaction are nitrous oxide and small amounts of nitrogen. Using the observed rate constant and the literature value for the Henry's Law constant for nitric oxide in water, k is calculated at 0 C. The enthalpy of activation for the reaction is calculated as 10. kcal/mole and the entropy of activation as -12 cal/deg/mole, referred to 1 M aqueous NO. The mechanism is interpreted as involving a step in which NO, acting as a Lewis acid, attacks the lone pair of electrons on the Sn2+ ion to form an intermediate adduct. Chloride increases the rate of the reaction. Kinetic evidence is presented for a 1:1 strongly bound mixed-valence species formed when sodium stannate is added to the reaction solution in amounts less than the tin(II) present. Dissert. Abstr.

N76-28384 Kent State Univ., Ohio.
VANADIUM(2) REDUCTION OF SOME PENTAAMMINE COBALT(3) COMPLEXES AND RELATED REACTIONS Ph.D. Thesis
Jean Chin-Chun Chen Thomas 1975 149 p
Avail: Univ. Microfilms Order No. 76-14371

The specific rates of reduction were first order in both the oxidant and reductant as in the case of Cr(II) reduction. A comparison of the specific rates of reduction by V(II) versus Cr(II) reductions generates a linear free energy relationship. These linear free energy relationships coupled with the substitution

limited inner-sphere rate for V(II) are taken to indicate a similarity in mechanism between these two reducing agents. A few of the Co(III) complexes are known to exhibit an acidity dependence in their specific rates of reduction. These acidity patterns were also observed for reductions of 2, 3-pyridine dicarboxylato, acetato, propionato and p-formyl benzoato complexes by V(II). In the cases where differences in acidity pattern between Cr(II) and V(II) reduction were observed they are in accord with the substitution-limited rate for inner-sphere reductions by V(II).
Dissert. Abstr.

N76-28385 California Univ., Los Angeles.
CONTRIBUTIONS TO THE THEORY OF BINARY NUCLEATION Ph.D. Thesis
William John Shugard 1976 96 p
Avail: Univ. Microfilms Order No. 76-15958

A noncontinuum theory of nucleation for the binary vapor system, H2SO4-H2O, is developed for both the steady state and transient nucleation rates. The theory accounts, among other things, for the effect of hydrate formation. The nonsteady theory of growth is developed as a random walk on a lattice, and a proof is presented to demonstrate that a random walk on a nontranslationally invariant lattice can always be described by a generalized master equation, and vice versa. Very small amounts of H2SO4 (0.000001 torr) are shown to be capable of nucleating supersaturated water vapor. A comparison of the theory with experiments was made, and qualitative agreement was achieved. A functional integral form for nucleation theory is formulated, and the validity of the peak integration approximation to the functional integral is discussed. Dissert. Abstr.

N76-28386 California Univ., Berkeley.
TOPICS IN PHYSICAL CHEMISTRY: MAGNETIC PROPERTIES OF OXYGEN, MIXED ELECTROLYTE SOLUTIONS, AND PSEUDOROTATION IN MX SUB 5 MOLECULES Ph.D. Thesis
Janice Joy Kim 1975 160 p
Avail: Univ. Microfilms Order No. 76-15257

A small amount of paramagnetic substance such as oxygen has been found to facilitate nuclear-spin-species conversion in solid methane in the low temperature phase (1-20 K). The nature of the oxygen molecule in a methane lattice and the magnetic properties of oxygen in relation to its role as a catalyst in the conversion of methane nuclear-spin-species were investigated. A model of oxygen in a methane lattice was described as a diatomic molecule undergoing hindered rotation in a cubic field and includes the Kramers dipole-dipole interaction between the two unpaired electrons in oxygen. It was shown that a dipole-dipole interaction between the unpaired electronic spin of oxygen and the nuclear spin of a methane proton can provide a mechanism for spin conversion between methane rotational levels. This interaction is an important pathway for thermal equilibration of methane spin species at low temperatures. Dissert. Abstr.

N76-28387 Illinois Univ., Urbana.
A SIMULTANEOUS, SPILT-BEAM, RATIOMETRIC SYSTEM FOR SPECTROCHEMICAL ANALYSIS Ph.D. Thesis
James Douglas Defreese 1976 209 p
Avail: Univ. Microfilms Order No. 76-16116

High intensity light sources are finding increased applicability for spectrochemical analyses, particularly in kinetic methods where high precision is required for measurement of small absorbance changes and in atomic fluorescence and molecular fluorescence determinations where higher source intensity leads to increased sensitivity. Photon statistical variations, which establish a fundamental limit on the attainable photometric precision, are improved by the higher photon fluxes obtained from intense light sources. However, intense light sources in general are more unstable than conventional sources because power supply requirements make output regulation difficult. Source instability can also manifest itself as pulse-to-pulse variations in the output intensity of pulsed or programmed light sources such as lasers or electronically modulated continuum sources. Dissert. Abstr.

N76-28388 Georgia Inst. of Tech., Atlanta.
ANALYSIS RELATED TO COMBUSTION NOISE RESEARCH Ph.D. Thesis
Magdy Mounir Wahbah 1975 151 p
Avail: Univ. Microfilms Order No. 76-15599

The first topic deals with internal noise generation in a constant area duct ending with a choked nozzle. In this study the effect of entropy waves moving towards the nozzle entrance is investigated. The noise generation is caused by the injection of an additional fluid at a different temperature from that of the main flow inside the duct. The solution is obtained by using a Fourier transform technique. The second topic deals with a new method for solving problems of sound radiation from semi-infinite ducts for the case of low Mach number. A new form of the Helmholtz integral formula is developed and then solved by a general collocation method. To check this technique, the method is first applied to the radiation problem solved exactly by Levine and Schwinger. Then it is used to solve the problem of a duct with a flow that has a density mismatch with that of the quiescent surroundings. Dissert. Abstr.

N76-28389 California Univ., Berkeley.
ON CYCLIC AND ANISOTROPIC PLASTICITY. 1: A GENERAL MODEL INCLUDING MATERIAL BEHAVIOR UNDER STRESS REVERSALS. 2: ANISOTROPIC HARDENING FOR INITIALLY ORTHOTROPIC MATERIALS Ph.D. Thesis
Yannis F. Dafalias 1975 283 p
Avail: Univ. Microfilms Order No. 76-15150

A general model was developed, capable of realistically describing nonlinearly hardening material behavior in the plastic range for multiaxial loadings with stress reversals. Material response to cyclic and monotomic loading conditions were obtained as special cases. The plastic modulus was recognized as the key phenomenological factor in describing the material behavior under complex loading conditions. Therefore, the main feature of the general model is the establishment of a constitutive law according to which the plastic modulus changes in the course of plastic deformation. Another model, a hardening model for an orthotropic material, was also developed. The main feature of this model is that the anisotropic parameters are orthotropic functions of the plastic strain tensor. Dissert. Abstr.

N76-28390*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE REACTIONS OF O(1D) AND OH WITH CH3OH, OXIDATION OF THE HCO RADIAL, AND THE PHOTOCHEMICAL OXIDATION OF FORMALDEHYDE
Terry Lee Osif Aug. 1976 142 p refs
(Grant NGL-39-009-003; NSF GA-12385; NSF GA-33446x; NSF GA-42856; EPA-R-800874)
(NASA-CR-148511; PSU-IRL-SCI-447) Avail: NTIS HC $6.00 CSCL 07D

An experimental, laboratory study of the various photochemical reactions that can occur in the mesosphere and stratosphere is presented. N2O was photolyzed at 2139 A in the presence of CH3OH and CO. The O(id) produced in the photolysis reacted with CH3OH to produce OH radicals, and thus the reactions of both O(id) and OH were able to be studied. Also considered was the oxidation of the HCO radical. Mixtures of Cl2, O2, H2CO, and sometimes N2 or He were irradiated at 3660 A at several temperatures to photodecompose the Cl2. The photochemical oxidation of formaldehyde was studied as follows: formaldehyde in the presence of N2 and/or O2 (usually dry air) was photolyzed with a medium pressure Hg lamp used in conjunction with various filters which transmit different relative amounts of Hg lines from 2894 A to 3660 A. Results are presented and discussed, along with a description of experimental procedures and apparatus, and chemical reaction kinetics.Author

N76-28391*# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
CHEMICAL VAPOR DEPOSITION GROWTH
R. P. Ruth, H. M. Manasevit, J. L. Kenty, L. A. Moudy, W. I. Simpson, and J. J. Yang 1 Jul. 1976 93 p refs Prepared for JPL
(Contract NAS7-100; JPL-954372)
(NASA-CR-148537; C76-320.2/501; ERDA/JPL-954372-76/2; QR-2) Avail: NTIS HC $5.00 CSCL 07D

The chemical vapor deposition (CVD) method for the growth of Si sheet on inexpensive substrate materials is investigated.

The objective is to develop CVD techniques for producing large areas of Si sheet on inexpensive substrate materials, with sheet properties suitable for fabricating solar cells meeting the technical goals of the Low Cost Silicon Solar Array Project. Specific areas covered include: (1) modification and test of existing CVD reactor system; (2) identification and/or development of suitable inexpensive substrate materials; (3) experimental investigation of CVD process parameters using various candidate substrate materials; (4) preparation of Si sheet samples for various special studies, including solar cell fabrication; (5) evaluation of the properties of the Si sheet material produced by the CVD process; and (6) fabrication and evaluation of experimental solar cell structures, using standard and near-standard processing techniques. Author

N76-28392*# California Inst. of Tech., Pasadena.
ON THE SPUTTERING OF BINARY COMPOUNDS
P. K. Haff and Z. E. Switkowski (Copenhagen Univ., Denmark) [1975] 11 p refs
(Grant NGR-05-002-333; NSF PHY-76-02724)
(NASA-CR-148538) Avail: NTIS HC $3.50 CSCL 07D

A simple physical model is presented to describe some aspects of the sputtering of compound targets. In particular, expressions are developed for the partial sputtering yields for binary systems in terms of the elemental sputtering rates, the stoichiometric concentrations and surface binding energy. The partial yields depend non-linearly on the bulk target concentrations. Comparison of the theoretical predictions with the data on sputtering of PtSi, NiSi and Cu3Au indicates that the general features are well described. Author

N76-28393*# Gulf South Research Inst., New Orleans, La.
WATER VAPOR DIFFUSION MEMBRANES, 2 Annual Report
F. F. Holland, Elias Klein, James K. Smith, and Charlie Eyer 1 Apr. 1976 62 p refs
(Contract NAS2-7650; GSRI Proj. 323-649-10)
(NASA-CR-137814) Avail: NTIS HC $4.50 CSCL 07D

Transport mechanisms were investigated for the three different types of water vapor diffusion membranes. Membranes representing porous wetting and porous nonwetting structures as well as dense diffusive membrane structures were investigated for water permeation rate as a function of: (1) temperature, (2) solids composition in solution, and (3) such hydrodynamic parameters as sweep gas flow rate, solution flow rate and cell geometry. These properties were measured using nitrogen sweep gas to collect the effluent. In addition, the chemical stability to chromic acid-stabilized urine was measured for several of each type of membrane. A technology based on the mechanism of vapor transport was developed, whereby the vapor diffusion rates and relative susceptibility of membranes to fouling and failure could be projected for long-term vapor recovery trials using natural chromic acid-stabilized urine. Author

N76-28394# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
EQUILIBRIUM COMPOSITION DATA FOR COMBUSTIBLE STOICHIOMETRIC MIXTURES OF HYDROGEN-OXYGEN (WATER)
Randy A. Roig Apr. 1976 13 p refs
(Grant AF-AFOSR-2274-72)
(UTIAS-TN-201) Avail: NTIS HC $3.50

Equilibrium properties of combustible stoichiometric mixtures of hydrogen oxygen (water) have been computed for a range of pressures and temperatures consistent with a gas driven implosion. Dissociation, ionization, and lowering of the ionization potential have been taken into account for computation of the chemical equilibrium conditions. The results should provide insight into spectroscopic data obtained from gas driven implosions. Author

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-28395 Brown Univ., Providence, R.I.
MICROSTRUCTURAL STRENGTHENING: CRITERIA AND APPLICATION TO A BETA-TITANIUM ALLOY Ph.D. Thesis
Ned William Polan 1975 103 p
Avail: Univ. Microfilms Order No. 76-15695

One means of optimizing high strength and high ductility in metals can be characterized on the basis of several criteria: (1) a metastable, single-phase fcc or bcc starting material; (2) a low strain-hardening exponent and good workability; (3) a low stacking-fault energy and high recovery temperature; (4) a hardening mechanism active below the recovery temperature; and (5) a low sensitivity of flow stress to temperature. By application of these criteria, mechanical-thermal processing of a beta-titanium alloy has yielded a material with an ultimate tensile strength in excess of 320,000 psi with 15% RA, exhibiting ductile behavior at elastic strains greater than 2%. The highest strength attained is equivalent to 1/3 the theoretical shear strength; it is equaled in a bulk metal only by patented steel wire. Combinations of strength and ductility can be manipulated within a wide range by varying the amount of cold work and the aging treatment. Dissert. Abstr.

N76-28396 Texas Univ., Austin.
CHEMICAL POTENTIALS OF LIQUID SODIUM-TELLURIUM ALLOYS Ph.D. Thesis
Shelie Monroe Granstaff, Jr. 1975 105 p
Avail: Univ. Microfilms Order No. 76-14458

Thermodynamic properties of molten metallic solutions, liquid alloys, are studied to determine the nature of the interaction of the constituents of the alloy. The concentration fluctuations are particularly useful for discovering tendencies toward cluster formation and phase separation, thus suggesting whether atoms of one kind prefer associations with atoms of their own kind or with atoms of another kind. The chemical potentials of molten Na-Te alloys are determined by measuring the electromotive force (emf) of Na in a Na-Te electrochemical cell using a solid electrolyte of sintered Na beta-alumina. Dissert. Abstr.

N76-28397 Cornell Univ., Ithaca, N.Y.
JOSEPHINITE: A UNIQUE NICKEL-IRON Ph.D. Thesis
Robert Irving Botto 1976 278 p
Avail: Univ. Microfilms Order No. 76-14839

Metallographic, mineralogical, and chemical analyses performed indicate that josephinite probably formed over a range of temperatures (from about 500 to below 350 C) in a chemically evolving serpentinization environment. Specimens displaying the taenite-awaruite-andradite intergrowths probably formed above about 450 C. The original metal was a single phase, taenite. Specimens formed at the lower temperature (below 375 C) end of this range contain only awaruite, and display associated minerals, textures, and a chemical composition more typical of other occurrences of this mineral. The chemical components of josephinite were originally incorporated in the structures of orthomagmatic silicates, or in traces of sulfides and arsenides making up unaltered harzburgite within the Josephine peridotite. Subsequent serpentinization within the ultramatic rock mass freed these components, which, as ions were dissolved in and transported by hydrothermal fluids moving through the serpentinite. Dissert. Abstr.

N76-28398 Brown Univ., Providence, R.I.
MODELS OF INTERGRANULAR CREEP CRACK GROWTH BY COUPLED CRACK SURFACE AND GRAIN BOUNDARY DIFFUSION Ph.D. Thesis
Tze-jer Chuang 1976 95 p
Avail: Univ. Microfilms Order No. 76-15618

The diffusive growth of voids along grain boundaries is studied. The Ashby model of a single or periodic highly elongated crack-life cavity is chosen as a basis, in contrast to the well known Hull-Rimmer model of a spherical void array. The mechanisms involved in this model are purely diffusive and carry the atoms at the crack surface into the grain boundary ahead of the advancing crack tip by surface and grain-boundary diffusion, so that a steady state model is readily established in which the crack is growing at steady speed V with a constant void shape near its tip. The estimation of the applied load or specifically the crack tip stress

intensity factor K necessary to drive the crack at V is made on several models. Gradients of the stress acting on the interface drive the grain-boundary diffusion whereas the stress distribution itself is the sum of that due to the applied load plus the misfit residual stress due to nonuniform addition of atoms to the abuting grains by diffusion transport from the crack surface. This couples the elastic deformation and interfacial diffusion parts of the problem and yields a control equation for the total stress distribution. Dissert. Abstr.

N76-28399 North Carolina State Univ., Raleigh.
A STUDY OF SURFACE INTEGRITY IN MACHINING 18 PERCENT NICKEL MARAGING STEEL Ph.D. Thesis
Shaik Jeelani 1976 258 p
Avail: Univ. Microfilms Order No. 76-14325

The effect of cutting speed and tool wear land length on the surface integrity of annealed, solution treated and aged 18% Nickel Maraging Steel machined under dry and lubricated conditions is determined. The surface region of machined test pieces is examined using optical microscopy, scanning electron microscopy, microhardness measurements, profilometry, infrared photography, grid method and deflection-etching technique. In addition, tool forces are measured and tool temperatures calculated. The results of the investigation show that during machining a damaged surface region is produced which is quite different from the bulk of the material. It is found that when cutting at low speeds with sharp tools the damage is restricted to a variety of geometrical defects associated with the surface. When cutting at high speeds or with tools having large artificially controlled wear lands it is found that considerable subsurface damage involving plastic deformation, change in hardness and residual stress is produced. Dissert. Abstr.

N76-28400 Brown Engineering Co., Inc., Huntsville, Ala.
CRYSTAL GROWTH AND CHARACTERIZATION OF PLATINUM DIPHOSPHIDE AND PLATINUM DISULFIDE Ph.D. Thesis
Arlington Levart Finley 1975 70 p
Avail: Univ. Microfilms Order No. 76-15634

Large single crystals of PtP sub 2 were prepared from a tin flux. A mixture of 80 weight percent tin and a platinum to phosphorus molar ratio of 1 to 2.5, heated slowly to 1200 C, allowed to soak for 24 hours, and slow cooled to 550 C, produced the largest, best-formed crystals of PtP sub 2. X-ray diffraction analysis, density measurements and spectroscopic chemical analysis were performed on the crystals. Crystallographic measurements show that PtP sub 2 crystalizes in the pyrite structure, space group Pa3. X-ray intensity data were used to refine the phosphorus positional parameter, X. The lattice parameter and the phosphorus positional parameter were used to calculate the average P-P bond distance. Density measurements indicate that PtP sub 2 is a stoichiometric compound. However, emission spectroscopy studies show the presence of 0.02 percent tin in the PtP sub 2 crystals. Field-dependent magnetic susceptibility measurements give no indication of ferromagnetic impurities, and temperature-dependent magnetic susceptibility data show the material to be diamagnetic. The preparation of single crystals of PtS sub 2 is described, and results of X-ray diffraction analysis, density measurement, and spectroscopic chemical analysis are also given. Dissert. Abstr.

N76-28401 California Univ., Berkeley.
KINETICS AND MECHANISMS OF SINGLE PHASE SOLID STATE SINTERING Ph.D. Thesis
Boon Wong 1975 171 p
Avail: Univ. Microfilms Order No. 76-15426

Both theoretical and experimental studies of kinetics and mechanisms of single phase solid state sintering are presented. Sintering kinetic models based on rate controlling mass transport mechanisms, unified macroscopic viscous flow, and microscopic vacancy diffusion concepts were used to develop equations for both the intermediate and final stages of sintering. Experimental sintering studies on both undoped and CaO doped MgO powder compacts in static air and flowing water vapor atmospheres were performed in a temperature range between 1280 C and 1600 C. Corresponding microstructural changes of sintered specimens during sintering were examined with a scanning electron microscope. Sintering kinetic data obtained were subsequently analyzed in terms of the appropriate proposed models; mechanisms of the sintering processes under different experimental conditions were thus determined. Dissert. Abstr.

N76-28402 Georgia Inst. of Tech., Atlanta.
THE INFLUENCE OF MICROSTRUCTURE ON STRESS CORROSION CRACKING OF MILD STEEL IN SYNTHETIC CAUSTIC-NITRATE NUCLEAR WASTE SOLUTION Ph.D. Thesis
Peter Gregory Sarafian 1976 215 p
Avail: Univ. Microfilms Order No. 76-16452

The influence of alloy microstructure on stress corrosion cracking of mild steel in caustic-nitrate synthetic nuclear waste solutions was studied. An evaluation was made of the effect of heat treatment on a representative material (ASTM A 516 Grade 70) used in the construction of high activity radioactive waste storage tanks at Savannah River Plant. Several different microstructures were tested for susceptibility to stress corrosion cracking. Precracked fracture specimens loaded in either constant load or constant crack opening displacement were exposed to a variety of caustic-nitrate and nitrate solutions. Results were correlated with the mechanical and corrosion properties of the microstructures. Crack velocity and crack arrest stress intensity were found to be related to the yield strength of the steel microstructures. Fractographic evidence indicated pH depletion and corrosive crack tip chemistry conditions even in highly caustic solutions. Dissert. Abstr.

N76-28403 Brown Univ., Providence, R.I.
COMBINED EFFECTS OF PARTICLE AND BOUNDARY STRENGTHENING IN SPHEROIDIZED STEELS Ph.D. Thesis
Lallit Anand 1975 172 p
Avail: Univ. Microfilms Order No. 76-15605

The combined effects of cementite particles, grain boundaries, and subgrain boundaries on the room temperature yielding and strain hardening behavior of spheroidized plain carbon steels were investigated. The strain hardening behavior of the spheroidized steels was examined in terms of recent continuum and quasi-continuum models based on the requirement that continuity be maintained at various boundaries in the two phase polycrystal. For plastic strains up to 3.5% the increase in the flow stress appears to be composed of contributions arising from dislocations stored in the material and an average back stress due to the presence of the unrelaxed plastic strain discontinuity between the matrix and the particles. The latter contribution, which is a large fraction of the total strain hardening increment, increases rapidly with strain up to a plastic strain of 3.5% and remains approximately constant thereafter. Dissert. Abstr.

N76-28404*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
IMPROVEMENT OF BLACK NICKEL COATINGS Final Report
R. E. Peterson and J. H. Lin Jun. 1976 62 p refs
(Contract NAS8-31545)
(NASA-CR-149928) Avail: NTIS HC $4.50 CSCL 11F

Selectively absorbing black nickel coatings are among the most optically efficient low cost coatings for use on flat plate solar collectors. However, a current Ni-Zn-S-O coating in use is quite susceptible to a humid environment, degrading badly in less than ten days at 38 C (100 F) at 95 percent relative humidity. Therefore, a black nickel formula was developed which can withstand such exposures with no loss of optical efficiency, solar absorption of > 0.92 and an infrared emittance (at 100 C) of < 1.00 were still present after 14 days of humidity exposure. This compares to a solar absorptance of only 0.72 for the previous formula after a similar time period. The electroplating bath and conditions were changed to obtain the more stable coating configuration. The effect of bath composition, temperature, pH, and plating current density and time on the coating composition, spectral optical properties and durability were investigated systematically. Author

N76-28405*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PREDICTION AND VERIFICATION OF CREEP BEHAVIOR IN METALLIC MATERIALS AND COMPONENTS FOR THE

SPACE SHUTTLE THERMAL PROTECTION SYSTEM Summary Report
John W. Davis and Bruce A. Cramer Washington NASA Jul. 1976 91 p refs
(Contract NAS1-11774)
(NASA-CR-2685) Avail: NTIS HC $5.00 CSCL 11F

A method of analysis was developed for predicting permanent cyclic creep deflections in stiffened panel structures. This method uses creep equations based on cyclic tensile creep tests and a computer program to predict panel deflections as a function of mission cycle. Four materials were investigated - a titanium alloy (Ti-6Al-4V), a cobalt alloy (L605), and two nickel alloys (Rene'41 and TDNiCr). Steady-state and cyclic creep response data were obtained by testing tensile specimens fabricated from thin gage sheet (0.025 and 0.63 cm nominal). Steady-state and cyclic creep equations were developed which describe creep as a function of time, temperature and load. Tests were also performed on subsize (6.35 x 30.5 cm) rib and corrugation stiffened panels. These tests were used to correlate creep responses between elemental specimens and panels. The panel response was analyzed by use of a specially written computer program. Author

N76-28406# Dow Chemical Co., Golden, Colo.
INVESTIGATIONS OF INTERACTIONS BETWEEN MECHANICALLY STRESSES METAL SURFACES AND GASES BY MEANS OF RADIOACTIVE LABELLING
E. Schober [1976] 3 p Transl. into ENGLISH from Schmierungstechnik (Duesseldorf), v. 2, no. 9, 1971 p 282-283 Sponsored by ERDA
(RFP-Trans-174) Avail: NTIS HC $4.50

Tribosorption processes in copper/carbon dioxide, copper/krypton, and gold/carbon dioxide systems were investigated. It was found that changes in the physicochemical properties of mechanically stressed metals are caused by frictionally adsorbed gases, surface area increases, production of fresh surfaces, and creation of energetically and morphologically well defined states. Author (ERA)

N76-28407# Army Materials and Mechanics Research Center, Watertown, Mass.
MICROSTRUCTURAL EFFECTS ON THE STRESS CORROSION CRACKING BEHAVIOR OF Ti-8Al-1Mo-1V IN METHANOLIC AND CHLORIDE SOLUTIONS Final Report
W. F. Czyrklis and Milton Levy Oct. 1975 18 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A018793; AAMRC-TR-75-21) Avail: NTIS CSCL 11/6

The stress corrosion cracking behavior of Ti-8Al-1Mo-1V has been studied in several environments. Of the environments employed, methanol with a small addition of hydrochloric acid was found to be the most aggressive. Altering the microstructure of the alloy produced a marked improvement in resistance to stress corrosion cracking in distilled water and salt water media. The SCC susceptibility was also significantly decreased by the addition of sodium nitrate to both salt water and methanol plus hydrochloric acid environments. Fractographic analyses have been carried out and related to SCC behavior. Author (GRA)

N76-28408# Advisory Group for Aerospace Research and Development, Paris (France). Structures and Materials Panel.
REVIEW OF ADVANCED POWDER METALLURGICAL FABRICATION TECHNIQUES IN EUROPEAN NATO COUNTRIES
P. W. Sutcliff (Atomic Energy Res. Estab., Harwell, England) Jun. 1976 12 p
(AGARD-R-641; ISBN-92-835-1220-0) Avail: NTIS HC $3.50

Various hot consolidation techniques currently under investigation are described for the fabrication of titanium and nickel alloys for application in high-integrity, highly stressed aeroengine components. The present state of the art in this field is evaluated and recommendations made relevant to the preparation of the forthcoming specialists' meeting on Advanced Fabrication Techniques in Powder Metallurgy and their Economic Implications. Author

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-28409 Massachusetts Univ., Amherst.
SYNTHESIS OF POLYMERIC AND OLIGOMERIC ULTRAVIOLET ABSORBERS Ph.D. Thesis
David Benedict Bailey 1976 321 p
Avail: Univ. Microfilms Order No. 76-14668

Polymeric ultraviolet absorbers were synthesized by the polymerization of vinyl substituted ultraviolet absorbers and by mild polymer modification reactions. Oligomeric ultraviolet absorbers were synthesized by endcapping of oligo-(oxyethylenes) varying in molecular weight from 62 to 400. Methyl salicylate, a commonly used ultraviolet absorber, was substituted in the position para to the phenol group with a vinyl group by a five-step synthesis. the overall yield of methyl 5-vinyl salicylate was 37%. Methyl 5-vinylsalicylate was polymerized and copolymerized with methacrylic acid or acrylic acid in order to obtain polymeric ultraviolet absorbers. Methyl 5-vinyl acetyl salicylate was also synthesized and polymerized to yield a high molecular weight polymer. Dissert. Abstr.

N76-28410 Massachusetts Univ., Amherst.
STUDIES IN POLYMER COMPATIBILITY Ph.D. Thesis
Eugene B. Wilusz 1976 141 p
Avail: Univ. Microfilms Order No. 76-14661

The dielectric relaxation behavior of the polymer (PCL) was studied over a wide range of frequency and temperature. The polymer was found to melt in the vicinity of 60 C. The main glass transition temperature was found to occur at -50 to -60 C with an activation energy of 152 kcal/mole. A sub-glass relaxation was found in the range -90 to -120 C with an activation energy of 11 kcal/mole and was attributed to short range motions involving the ester groups. The magnitudes of the relaxations were determined and found to be in general agreement with those of similar polymers. Polyblends were also prepared of isotactic polystyrene (i-PS) and poly(2,6 -dimethyl-1,4-phenylene oxide) (PPO) and were found to be compatible over the entire range of composition by differential scanning calorimetry and dynamic mechanical measurements. Dissert. Abstr.

N76-28411 Case Western Reserve Univ., Cleveland, Ohio.
THE THEORY OF THE EPITAXIAL CRYSTALLIZATION OF POLYMERS ON ALKALI HALIDE SUBSTRATES Ph.D. Thesis
Kenneth Andrew Mauritz 1975 321 p
Avail: Univ. Microfilms Order No. 76-16056

A computer simulation of the interfacial energetics in the epitaxial crystallization of simple polymers, from solution, upon NaCl-type alkali halide crystals was performed. The calculations indicate that adhesive and orientation-inducing forces are short-ranged and of a dispersive rather than electrostatic nature. Modification of the interfacial energetics to account for an expenditure of energy needed to displace solvent molecules has resulted in an energy of activation that is characteristic of a given polymer-solvent-substrate combination. A prototype model involving the interchain energetics in a simulated initially-deposited polymer monolayer was developed and evaluated for the PE-NaCl system. Three energetically stable two-dimensional crystals were predicted, one of which corresponds to the packing of chains in the growth plane of the experimentally observed monoclinic lattice. The computations indicate that the substrate forces induce a strain within the monolayer that results in specific positioning of PE chains over Na+ rows. Dissert. Abstr.

N76-28412 Maryland Univ., College Park.
SYNTHESIS OF MONOMERS WHICH EXPAND ON POLYMERIZATION Ph.D. Thesis
Robert Li-jiun Sun 1975 147 p
Avail: Univ. Microfilms Order No. 76-15933

The fact that monomers shrink considerably during polymerization causes a variety of problems in the polymer industry. A series of bicycle monomers were prepared and the volume changes during polymerization were studied. Dissert. Abstr.

N76-28413 Massachusetts Univ., Amherst.
ELONGATION FLOW OF POLYMER SOLUTIONS Ph.D. Thesis
Glen Hamilton Pearson 1976 427 p
Avail: Univ. Microfilms Order No. 76-14656

A particular need has existed for a method to study the response of moderately viscous polymer solutions and melts. Realizing this need, an experimental technique was developed for transparent polymer solutions which utilizes the extensional flow created by a gas bubble collapsing in a sea of fluid. Starting with the fluid at rest, a small bubble of air is introduced through a capillary and brought to rest on top of the capillary. Motion is induced by subjecting the bubble to a rapid change in pressure. By filming the collapsing bubble with a high speed camera, the kinematics of the process may be obtained. The bubble pressure function which is related to the normal stress difference at the surface of the bubble may also be calculated. This bubble pressure function with the kinematics can be used to define an apparent elongational viscosity from the experiment. While an extensive experimental program was not undertaken, enough experiments were performed to establish the viability of the technique. Three fluids were studied: (1) a silicone oil; (2) a 2 percent hydroxypropylcellulose in water solution; and (3) a 1 percent polyacrylamide in 50/50 glycerin/water solution. Four viscoelastic models used to simulate bubble collapse are also described. Dissert. Abstr.

N76-28414 Georgia Inst. of Tech., Atlanta.
QUANTITATIVE STUDIES OF POLYMER CRYSTALLIZATION UNDER NON-ISOTHERMAL CONDITIONS Ph.D. Thesis
Donald Gene Bright 1975 213 p
Avail: Univ. Microfilms Order No. 76-15515

A kinetic growth rate expression developed by Hoffman in the Avrami relation is used for predicting changes in crystallinity based on the phenomenological mechanisms of polymer crystallization. The kinetic growth rate expresslon was incorporated into an alternate relation, the volumetric growth relation, for predicting changes in crystallinity. The kinetic parameters can be determined from two data points collected under isothermal and non-isothermal cooling conditions; the average size of the spherulites at impingement, and the associated time and temperature at impingement. For simulations of isothermal and non-isothermal crystallizations, the volumetric growth relation predicted the correct crystallinity at the appropriate temperatures based solely on the crystallization kinetics. Dissert. Abstr.

N76-28415 Case Western Reserve Univ., Cleveland, Ohio.
THE EFFECTS OF HIGH BONDING PRESSURES ON FRACTURE OF ADHESIVE JOINTS AND REINFORCED POLYMERS Ph.D. Thesis
Ricardo Vera Graziano 1975 194 p
Avail: Univ. Microfilms Order No. 76-16045

The effect on joint strength of four different high pressure-temperature bonding cycles was studied. These cycles were designed to study the effect of built-in stresses and effective contact area on the strength of glass-polystyrene butt joints. It was shown that built-in stresses can be reduced to zero concurrent with maximizing contact area by iso-volume solidification of the molten adhesive. Increases in joint tensile strength up to 100 percent were observed in the joints made under this iso-volume cycle. Dissert. Abstr.

N76-28416 Case Western Reserve Univ., Cleveland, Ohio.
THE MECHANICAL PROPERTIES OF AMORPHOUS POLYMERS UNDER HIGH PRESSURE Ph.D. Thesis
Kasumi Matsushige 1975 197 p
Avail: Univ. Microfilms Order No. 76-16062

The effect of hydrostatic pressure on the tensile mechanical behavior of two amorphous polymers -- polystyrene (PS) and poly(methylmethacrylate) (PMMA) was studied up to 4.0 kilobars (kb) and at various temperatures with particular emphasis on the effect of test media. The liquids used as pressure-transmitting fluids such as silicon oil were found to serve as a strong environmental stress-crazing and cracking agent for amorphous polymers under pressure. The environmental effects changed fracture modes drastically and caused a substantial lowering in craze initiation and fracture stresses but little influence on yielding process. When specimens were sealed with Teflon tape and rubber to prevent the environmental effects, both PS and PMMA showed a brittle to ductile transition at relatively low pressures, 0.35 kb and 0.25 kb, respectively at room temperature. A detailed stress-strain analysis permitted explanation of the mechanism for the brittle to ductile transition in terms of interaction between two competing processes of plastic deformation-crazing and shear banding phenomena. Dissert. Abstr.

N76-28417*# Avco Corp., Lowell, Mass. Systems Div.
QUINOXALINE POLYMERS AND COPOLYMERS DERIVED FROM 1,4-BIS(1'-NAPHTHALENYLOXALYL)BENZENE AND THEIR GRAPHITE COMPOSITES Final Report, 7 Feb. 1975 - 30 Apr. 1976
William S. Port Jul. 1976 92 p refs
(Contract NAS3-18936)
(NASA-CR-135042; AVSD-0199-76-RR) Avail: NTIS HC $5.00 CSCL 11D

Experimental studies were performed with new polyquinoxalines and their graphite composites. Four polymers were synthesized, and then were characterized with respect to their inherent viscosity, elemental chemical analysis, mechanical, and thermodynamic properties. Structural formulas of the polymers and their precursors are given; methods of synthesis are described; and specifically examined was the preparation of polymers from 3,3' diamino-benzidine from 1,4- and 1,3- bis ((1'-napthalenyl) oxalyl) benzene respectively. Also considered was the preparation of polyquinoxalines from poly (p-benzil), and 1,2- aryldiamines. Author

N76-28418*# Old Dominion Univ. Research Foundation, Norfolk, Va.
STUDIES IN HETEROCYCLIC SYNTHESIS: INVESTIGATION INTO THE SYNTHESIS OF NEW MALEMIDE ADDITION POLYMERS Final Report
R. L. Williams and R. Brown Aug. 1976 38 p refs
(Grant NGL-47-003-008)
(NASA-CR-148483) Avail: NTIS HC $4.00 CSCL 07C

Several new heterocyclic ring systems were synthesized as part of an investigation into potential monomers for fabricatable, high temperature polymers. 1H-2, 3-dimethylpyrrolo (1, 2-a) benzoimidazoli-one (23) and 1H, 9H-2, 3, 7, 8-tetramethyl-bispyrrolo(1, 2-a:6, 7-a')benzoimidazol-1, 9-dione (30) have been synthesized using dimethylmaleic anhydride and o-phenylenediamine and 1, 2, 4, 5-tetraaminobenzene, respectively. The synthesis of the above compounds involved a simple nucleophilic substitution reaction between the anhydride and the respective diamines. The initial amide-acid-amine intermediates were not isolated but were found to cyclize immediately to the corresponding imide-amine species. The final ring closure of these imide-amines could only be achieved under vigorous conditions and at melt reaction temperatures. Author

N76-28419*# Kanner (Leo) Associates, Redwood City, Calif.
ELECTRONIC PROPERTIES OF A PITCH COKE DOPED WITH BORON
P. Delhaes Washington NASA Jul. 1976 23 p refs Transl. into ENGLISH from Carbon (England), v. 3, 1965 p 115-124
(Contract NASw-2790)
(NASA-TT-F-17135) Avail: NTIS HC $3.50 CSCL 11D

Small amounts of boron were introduced into samples of pitch coke heat treated at temperatures ranging from 1580 to 2350 C. Measurements of diamagnetic and paramagnetic susceptibilities at various temperatures between 80 and 300 K, as well as room temperature measurements of the Hall coefficient, were performed on these boronated samples. The thermal dependence of the diamagnetic susceptibility is unusual, but this behavior is in agreement with the theoretical predictions of McClure. The shift of the Fermi level and the amount of boron substituted for carbon atoms into the graphitic lattice are estimated from the changes observed in the diamagnetic susceptibility. Author

N76-28420*# Whittaker Corp., San Diego, Calif.
SYNTHESIS AND DEVELOPMENT OF LOW COST, HIGH TEMPERATURE N-ARYLENE POLYBENZIMIDAZOLE FOAM MATERIAL Annual Summary Report, May 1974 - Jun. 1975
E. S. Harrison Jun. 1975 65 p refs Original contains color

illustrations
(Contract NAS2-8299)
(NASA-CR-137736) Avail: NTIS HC $4.50 CSCL 11G

Polymer (and foam) studies followed two basic routes: (1) formation of high molecular weight uncyclized polyamide followed by subsequent fusion and cyclodehydration to yield NABI (foam) and (2) polymer and foam formation by reaction of diphenyl esters (or anhydrides) with the tetramine. The latter route was found much more attractive since considerable versatility in both basic polymer structure and crosslinkability is achievable. Preliminary studies on BAB, phthalic anhydride (PA), and 3, 3 (prime), 4, 4(prime) benzo pheno netetracarboxylic acid dianhydride (BTDA) as crosslinked polymer precursors were conducted. Nonmelting rigid char forming foams with densities as low as 2.7 lb/cubic ft. were achieved. The program was successful in the preparation of a potentially low cost, low density, high char yield, high temperature foam material. Author

N76-28421*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
POLYMERIC FOAMS FROM CROSS-LINKABLE POLY-N-ARYLENEBENZIMIDAZOLES Patent Application
Edward S. Harrison (Whittaker Corp., San Diego, Calif.), Chadwick B. Delano (Whittaker Corp., San Diego, Calif.), and Salvatore R. Riccitiello, inventors (to NASA) Filed 26 Jul. 1976 24 p
(NASA-Case-ARC-11008-1; US-Patent-Appl-SN-708951) Avail: NTIS HC $3.50 CSCL 07C

Foamed cross-linked poly-N-arylene benzimi dazoles are prepared by mixing an organic tetraamine and an ortho substituted aromatic dicarboxylic acid anhydride in the presence of a blowing agent and then heating the prepolymer to a temperature sufficient to complete polymerization and foaming of the reactants. In another embodiment of the process, the reactants are heated to form a prepolymer. The prepolymer is then cured at higher temperatures to complete foaming and polymerization. NASA

N76-28422*# Acurex Corp., Mountain View, Calif. Aerotherm Div.
PLASTICIZED PHENOLPHTHALEIN POLYCARBONATE Final Report
Edward S. Harrison Jun. 1976 28 p refs
(Contract NAS2-8012)
(NASA-CR-137890; Aerotherm-76-202) Avail: NTIS HC $4.00 CSCL 11G

Phenolphthalein polycarbonate was successfully plasticized with polychlorinated biphenyls (e.g., Aroclor 1231) or tricresyl phosphate and cast from tetrahydrofuran to give clear films without loss of fire resistance. At loadings of 20 to 30 percent plasticizer the Tg was lowered to approximately 100 C which would render phenolphthalein polycarbonate easily moldable. Although these materials had some mechanical integrity as shown by their film forming ability, the room temperature toughness of the plasticized polymer was not significantly improved over unmodified polymer. Author

N76-28423*# Battelle Columbus Labs., Ohio.
CHEMILUMINESCENCE STUDY ON THERMAL DEGRADATION OF AIRCRAFT TIRE ELASTOMERS Final Report
G. David Mendenhall, T. B. Stanford, and Richard A. Nathan 30 Jun. 1976 63 p refs
(Contract NAS2-8195)
(NASA-CR-137856) Avail: NTIS HC $4.50 CSCL 11G

Since the autoxidative process accounts in part for the degradation of rubber, including aircraft tires, it was felt that a study of the chemiluminescence from unsaturated elastomers could contribute significantly to an understanding of the degradation mechanism. The study revealed similarities in chemiluminescence behavior between four elastomers which were investigated, and it shows that similar oxidation mechanisms occur. Oxidative chemiluminescence was observed from purified samples of cis-1,4-polybutadiene, cis-1,4-polyisoprene, trans-polypentenamer, and 1,2-polybutadiene in an oxygen atmosphere at 25-150 C. The elastomer samples were placed in a 600 watt oven which is equipped with gas inlets for introducing any desired atmosphere. Chemiluminescence emission from the samples was focused with a two inch quartz lens onto the detector of a 12' photomultiplier which is connected to a photon counter. A strip-chart recorder, connected to the counter, permitted automatic data collection. Diagrams of the apparatus are included. The chemical reactions which occurred from the thermal decomposition of the polymer samples are described, and results (and tabulated data) are discussed. Author

N76-28424*# Monsanto Research Corp., Dayton, Ohio.
EXPLORATORY STUDY ON THE EFFECTS OF NOVEL DIAMINE CURING AGENTS AND ISOCYANATE PRECURSORS ON THE PROPERTIES OF NEW EPOXY AND URETHANE ADHESIVES Annual Summary Report, 18 Jun. 1975 - 17 Mar. 1976
D. Gerald Glasgow May 1976 42 p refs
(Contract NAS1-13982)
(NASA-CR-145022; MRC-DA-555) Avail: NTIS HC $4.00 CSCL 11A

The effects of novel aromatic diamine structures on the adhesive properties of epoxy and polyurethane adhesives were studied. Aromatic diamines based on benzophenone and diphenyl-methane isomers were evaluated as curing agents for epoxy resins and benzophenone and diphenyl-methane based diamine isomers were evaluated as curing agents for polyurethane adhesives. Polyurethane adhesives were prepared based on m, m prime-diisocyanato-diphenyl-methane and m, m prime-diisocyanato-benzophenone. The m, m prime-diisocayanato-diphenyl-methane based adhesive had properties comparable to state-of-the-art adhesives. The m, m prime-diisocyanato-benzophenone based adhesive was extremely reactive. Author

N76-28425*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HEAT RESISTANT POLYMERS OF OXIDIZED STYRYLPHOSPHINE Patent Application
Kazimiera Paciorek, inventor (to NASA) (Ultrasystems, Inc., Irvine, Calif.) Filed 19 Jul. 1976 35 p Sponsored by NASA
(NASA-Case-MSC-14903-1; US-Patent-Appl-SN-706424) Avail: NTIS HC $4.00 CSCL 11G

Vinyl based polymers are prepared that are flame resistant and whose degradation products are non-toxic and non-corrosive. Reactant homopolymers, copolymers and terpolymers are prepared by polymerizing mixtures of azido oxidized styrylphosphine monomers and by polymerizing one or more of these monomers with a vinyl monomer such as styrene. Alternatively, the interpolymer is prepared by first polymerizing diphenyl-p-styryl phosphine either alone or with another vinyl monomer to prepare a polymer. The resulting polymer is then reacted with an organo-ozide to introduce phosphazene groups into the resultant polymers. NASA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-28426 Utah Univ., Salt Lake City.
REACTIONS IN SOLID PROPELLANTS DERIVED FROM INFRARED SPECTRA Ph.D. Thesis
Robert James Law 1976 122 p
Avail: Univ. Microfilms Order No. 76-16263

An infrared-absorption (IR) spectrometric technique for studying reactions in a solid was developed and applied to the system fine ammonium perchlorate dispersed in an organic polymer. The technique consists of provision for rapidly heating a thin film of the solid to the temperature of interest, focusing the beam from a hot IR source on the film, and analyzing the transmitted beam during the course of reaction. The technique was applied to the study of ammonium perchlorate composite propellant fuel binder reactions. Films of 25 thickness containing 30 to 50 percent of 5 microns diameter oxidizer were heated at rates of 80 to 150 K/s to preselected temperatures from 250 to 620 K. Spectra in the regions 2.5 to 5.5 microns or 5.5 microns were recorded at the rate of eight scans per second during heating and while at temperature for periods up to 60 seconds. Dissert. Abstr.

N76-28427 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL INVESTIGATION OF CATALYSIS IN THE COMBUSTION OF COMPOSITE SOLID PROPELLANTS Ph.D. Thesis
John Charles Handley 1976 214 p
Avail: Univ. Microfilms Order No. 76-16449

Experiments were conducted to provide data on the effectiveness and mechanism of action of four burn rate modifiers in the catalysis of the combustion of composite solid propellants. In addition, combinations of these modifiers were studied to determine if interaction effects on propellant burn rate exist. The four modifiers that were investigated were Harshaw catalyst Cu 0202 P, ferric oxide, iron blue, and ferrocene. The combustion pressure was varied from 600 to 2000 psia. Pairs of modifiers were added uniformly to two-dimensional solid propellant sandwiches to determine if there was a catalytic synergistic effect on sample burn rate. Synergistic catalytic effects on sample burn rate were obtained for the Harshaw catalyst Cu 0202 P. The extent of the binder melt flow observed on the two dimensional sandwiches was reduced by all catalysts at all pressures for the three types of catalyst loading. The catalysts were most effective in catalyzing the binder-oxidizer reactions when introduced hot into the gas phase for the sandwich configuration.Dissert. Abstr.

N76-28428*# AeroChem Research Labs., Inc., Princeton, N.J.
COMBUSTION EXPERIMENTS IN ORBITING SPACECRAFT Final Report, 3 Jun. - 30 Dec. 1974
Hartwell F. Calcote Dec. 1974 58 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953872)
(NASA-CR-148546; PB-251627/6; AeroChem-TP-316) Avail: NTIS HC $4.50 CSCL 21B

A study was conducted to determine what fundamental combustion experiment could advantageously be performed in the space shuttle. Lean mixture combustion studies were chosen from (1) a review of the status of experimental combustion research, (2) consideration of the environment offered by the space shuttle and (3) consideration of anticipated requirements for combustion information. In addition to utilizing the zero gravity environment offered by the space shuttle the large pumping capacity of space would be used. It is demonstrated that energy production will, for many decades, be dependent upon combustion of fossil fuels, and that to efficiently use available resources and to minimize degradation of the environment better understanding of lean limit phenomena will be required. Specifically, it is proposed to (1) determine lean flammability limits as a function of temperature and pressure, (2) determine burning velocity near the lean limit and (3) measure the product gases after ignition.
GRA

N76-28429*# Pratt and Whitney Aircraft, East Hartford, Conn.
EXPERIMENTAL CLEAN COMBUSTOR PROGRAM, PHASE 2
R. Roberts, A. Peduzzi, and G. E. Vitti Jul. 1976 86 p refs
(Contract NAS3-18544)
(NASA-CR-134970; PWA-5370) Avail: NTIS HC $5.00 CSCL 21D

The alternate fuels investigation objective was to experimentally determine the impacts, if any, on exhaust emissions, performance, and durability characteristics of the hybrid and vorbix low pollution combustor concepts when operated on test fuels which simulate composition and property changes which might result from future broadened aviation turbine fuel specifications or use of synthetically derived crude feedstocks. Results of the program indicate a significant increase in CO and small NOX increase in emissions at idle for both combustor concepts, and an increase in THC for the vorbix concept. Minimal impact was observed on gaseous emissions at high power. The vorbix concept exhibited significant increase in exhaust smoke with increasing fuel aromatic content. Altitude stability was not affected for the vorbix combustor, but was substantially reduced for the hybrid concept. Severe carbon deposition was observed in both combustors following limited endurance testing with No. 2 home heat fuel. Liner temperature levels were insensitive to variations in aromatic content over the range of conditions investigated.
Author

N76-28430# Army Materiel Command, Texarkana, Tex. Intern Training Center.
AN INVESTIGATION OF THE EFFECTS OF VENTING AND HOLE SPACING ON THE STRENGTH OF PLATES SUBJECTED TO SHOCK LOADING Final Report
Bernard R. Bindel Dec. 1975 115 p refs
(AD-A020519; USAMC-ITC-02-08-76-417) Avail: NTIS CSCL 19/1

This report describes the results of tests to determine the effect of venting and hole pattern on the ability of perforated plates, such as those used in suppressive shields, to withstand shock loading. The tests were performed in a low pressure shock tube at the Ballistics Research Laboratories in Aberdeen, Maryland. It was concluded from these tests that venting had little effect on the loading of the plate in the shock tube. The interaction of hole diameters and hole spacing as expressed by stress concentration factors, however, was found to significantly increase the strains in the plate after plastic deformation had occurred.
Author (GRA)

N76-28431# IIT Research Inst., Chicago, Ill.
TNT EQUIVALENCY OF M1 PROPELLANT (BULK) Final Report
J. J. Swatosh, Jr., J. Cook, and Paul Price Dec. 1975 95 p
(Contract DAAA21-73-C-0730)
(AD-A020479; IITRI-J6342-2; PA-TR-4885) Avail: NTIS CSCL 19/1

TNT equivalency tests were performed with M1, single and multi-perforated, propellant. Peak pressure and positive impulse was measured as a function of distance from the charges. Configurations tested were sealed shipping drum containers and scaled open top and closed top feed hoppers. The TNT equivalency for these propellants was computed from the test blast output measurements. It was determined that the single-perforated (0.013 inch web) M1 propellant yielded a higher blast output in all configurations tested, than the multi-perforated (0.025 inch web) M1 propellant. The highest TNT equivalencies computed were at small sealed distances, cube root of 3 ft. lb., for the sealed shipping drum configurations (M1-SP propellant). They were 240 and 170 percent for peak pressure and positive impulse respectively. In general, the measured blast output from the closed top feed hoppers was greater than that measured from the open top hoppers.
Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-28432 Minnesota Univ., Minneapolis.
MODELS FOR THE DYNAMICS OF SUPERFLUID HELIUM-4 Ph.D. Thesis
Roger Noel Hastings 1975 143 p
Avail: Univ. Microfilms Order No. 76-14899

Two models for the dynamics of superfluid helium-4 were studied both quantitatively and theoretically. The Zawadowski-Ruvalds-Solana (ZRS) model of quasi-particle interactions was used to calculate the spectra of neutron scattering and light scattering from liquid helium. It is found that the ZRS model cannot quantitatively describe the observed neutron scattering spectrum, and that the model can account for the experimental light scattering spectrum only if a restrictive assumption is made about the form of the quasi-particle coupling. The ZRS model is shown to be incapable of satisfying an excluded volume condition on the light scattering spectrum. A second model, suggested by the structure of a theory of boson pairing similar to the BCS theory of fermions, was constructed. It is shown that the two-branch long-wavelength excitation spectrum which emerges from the pairing model can describe the low-temperature anomaly in the helium-4 specific heat without contradicting existing direct measurements of the excitation spectrum.
Dissert. Abstr.

N76-28433*# National Academy of Sciences - National Research Council, Washington, D.C.
PROGRAM FOR DEVELOPING AND IMPLEMENTING A NEW APPROACH TO DESIGNING FOR FIRE SAFETY IN BUILDINGS
1975 38 p

(Contract NASw-2751)
(NASA-CR-148513; TR-67) Avail: NTIS HC $4.00 CSCL 13L

The traditional method of providing for fire safety in buildings through reliance on codes and standards that prescribe specific measures to be taken in the design and construction of buildings to minimize the potential for a fire occurring and to protect property and life should a fire occur was evaluated. A new approach to designing for fire safety in buildings is outlined.
Author

N76-28434# Southwest Research Inst., San Antonio, Tex.
MODEL TESTS OF INDUSTRIAL MISSILES Final Report
W. E. Baker, J. C. Hokanson, and R. Cervantes 1 May 1976 91 p refs
(SwRI Proj. 02-9153-001)
Avail: NTIS HC $5.00

The results are presented of a fairly comprehensive scale model study of certain classes of potentially damaging industrial missiles impacting targets which simulate nuclear reactor containment structures. A similitude analysis guides the testing. Details of model selection and construction, test arrangement and procedures, and all test results are reported. Data from the literature are compared with some of the model test data, appropriately scaled, although the data base is larger than available full-scale test data. Advantages of small-scale testing are discussed, and recommendations made for additional studies.
Author

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N76-28435 Rutgers Univ., New Brunswick, N.J.
CAVITY METHOD FOR EXPERIMENTAL DETERMINATION OF THE SCATTER MATRIX OF THREE DIMENSIONAL OBJECTS Ph.D. Thesis
J. Robert Christian 1976 153 p
Avail: Univ. Microfilms Order No. 76-16392

The concept of this approach is to surround the object by a conductive enclosure (cavity) instead of one having absorbing walls (anechoic chamber). The advantage of this approach is that the entire field surrounding the scatterer is confined within a relatively small, well-defined space which is not subject to uncontrollable external influences. Measurements performed on the fields inside the cavity yield data that can be applied to deriving the scatter matrix of the enclosed object. It is shown that the fields inside the cavity depend upon the scatter characteristics of the enclosed object, the reflection properties of the cavity walls, and on the excitation properties of the source. Since the latter two dependencies are mathematically predictable, information on the scatter characteristics of the object can be extracted from the measured field data. Sets of measured data, obtained when the object is repositioned inside the cavity, are required to determine the scatter matrix of the object.
Dissert. Abstr.

N76-28436 Rochester Univ., N.Y.
SHORT-WAVELENGTH SCATTERING OF ELECTROMAGNETIC WAVES BY A HOMOGENEOUS DIELECTRIC SPHERE Ph.D. Thesis
Vijay Khare 1976 331 p
Avail: Univ. Microfilms Order No. 76-14767

The objective is to obtain accurate asymptotic representations of the scattering amplitudes, valid in all directions, that provide physical understanding of the short-wavelength behavior and are convenient for numerical computation. The problem that is treated is the scattering of a monochromatic plane wave, with wave number k, by a homogeneous dielectric sphere of radius a and refractive index N. The asymptotic methods developed by Nussenzveig in connection with the short-wavelength scattering of a scalar field are applied to the electromagnetic problem. The procedure consists of two main steps: (1) the Debye expansion; an expansion in terms of multiple internal reflections, is applied to the partial-wave scattering amplitudes; (2) the modified Watson transformation, due to Nussenzveig, is applied to the resulting Debye amplitudes.
Dissert. Abstr.

N76-28437 Georgetown Univ., Washington, D.C.
EFFECTS OF LAMB WAVES ON ULTRASONIC BOUNDED BEAM PROPAGATION Ph.D. Thesis
Thomas Joseph Plona 1975 132 p
Avail: Univ. Microfilms Order No. 76-16453

Schlieren imaging techniques are used to show that nonspecular bounded beam reflection effects occur when a Lamb surface wave is excited by an ultrasonic beam incident at the Lamb angle at both water/brass-plate/water and water/Plexiglas-plate/water interfaces. These observed nonspecular reflection effects are analogous to the nonspecular reflection effects occurring at liquid/solid interfaces when a Rayleigh surface wave is excited by mode conversion at the Rayleigh angle. In addition, nongeometrical bounded beam transmission effects are also observed at Lamb angles at liquid/solid-plate/liquid interfaces. Through a comparison of plane wave reflectivity theory and surface wave propagation theory at liquid/solid interfaces with the analogous theories at liquid/solid-plate/liquid interfaces, it is shown that the bounded beam reflection theory for liquid/solid interfaces can be extended to liquid/solid-plate/liquid interfaces. An additional interpretation of the existence and nonexistence of bounded beam effects at Lamb angles is presented in terms of the Lamb surface wave particle displacement parameter beta.
Dissert. Abstr.

N76-28438 Oregon State Univ., Corvallis.
THE USE OF ELECTROMAGNETIC WALSH WAVES IN RADAR Ph.D. Thesis
Alvin Schaffer, Jr. 1976 289 p
Avail: Univ. Microfilms Order No. 76-14395

The question of the suitability of Walsh functions or similar bi-valued functions used as a radar electromagnetic carrier waveform is considered. Walsh functions are described, and effective sinusoidal steady state transfer functions are defined for transmission elements, antenna systems, and propagation media. The conclusion obtained is that radar system elements and the radar propagation medium are compatible to the use of Walsh functions as the functional form of the electromagnetic carrier wave if sound judgement is used.
Dissert. Abstr.

N76-28439 Illinois Univ., Urbana.
THE PROPAGATION OF PLANETARY SCALE WAVES INTO THE UPPER ATMOSPHERE Ph.D. Thesis
Mark Robin Schoeberl 1976 290 p
Avail: Univ. Microfilms Order No. 76-16190

An equation governing the propagation of planetary scale waves in the earth's atmosphere is derived by scaling a generalized form of Laplace's tidal equation. Quasi-analytic solutions to the propagation equation are obtained for certain model atmospheres in terms of approximate Hough functions and other special functions. These solutions are seen to be equivalent to solutions obtained by other authors for planetary waves propagating on a beta plane. Numerical solutions to the propagation equation are also obtained using January and July mean-zonal wind models for the Northern Hemisphere for the regions between 15 km and 100 km. The results show that the vertical structure of planetary scale waves is strongly dependent on the strength of the polar night jet in winter and upon the magnitude of the photochemical and radiative dissipation parameters in the stratosphere.
Dissert. Abstr.

N76-28440 California Univ., Berkeley.
COHERENT MICROWAVE PULSE PROPAGATION IN A MAGNETIC TWO-LEVEL SYSTEM Ph.D. Thesis
Stephen Bruce Grossman 1975 246 p
Avail: Univ. Microfilms Order No. 76-15200

The propagation of a short coherent microwave electromagnetic field pulse interacting with a paramagnetic electron spin two-level system is examined experimentally. The first case in which the magnetic microwave field displays self-induced transparency in the magnetic dipole coupled systems is measured. Zero area pulse propagation is displayed. A zero area pulse consists

of lobes of alternating relative phases of 0 deg and 180 deg. This causes induced absorption in the medium followed by induced emission, thereby returning the absorbed energy back into the propagating field. In one case the input is artificially constructed zero area pulses injected into the system. In the other case, short single-lobed small area pulses are injected into the system, and the spontaneous development into zero area pulses is observed for the first time. Nonlinear shifts in spectral frequencies of pulses off-resonance are observed. Dissert. Abstr.

N76-28441 California Inst. of Tech., Pasadena.
WAVE INTERACTIONS IN PERIODIC STRUCTURES AND PERIODIC DIELECTRIC WAVEGUIDES Ph.D. Thesis
Avraham Gover 1976 369 p
Avail: Univ. Microfilms Order No. 76-16374

A general analysis of wave interactions in periodic structures and particularly periodic thin film dielectric waveguides is presented. The electromagnetic wave propagation in an asymmetric dielectric waveguide with a periodically perturbed surface is analyzed in terms of a Floquet mode solution. First order approximate analytical expressions for the space harmonics are obtained. The solution is used to analyze various applications: (1) phase matched second harmonic generation in periodically perturbed optical waveguides; (2) grating couplers and thin film filters; (3) Bragg reflection devices; and (4) the calculation of the traveling wave interaction impedance for solid state and vacuum tube optical traveling wave amplifiers which utilize periodic dielectric waveguides. Some of these applications are of interest in the field of integrated optics. Dissert. Abstr.

N76-28442 Illinois Univ., Urbana.
A TRANSMITTING BOUNDARY FOR FINITE-DIFFERENCE ANALYSIS OF WAVE PROPAGATION IN SOLIDS Ph.D. Thesis
Min Nan Tseng 1976 132 p
Avail: Univ. Microfilms Order No. 76-16207

A theoretically based and effective transmitting boundary is developed. The fundamental procedure for obtaining such a transmitting boundary consists of the numerical decomposition of the displacement field into potential fields, for P and S waves in the vicinity of the boundary. Once the potentials are split, the local disturbances for separate P and S wave components can be approximated as envelopes of plane waves or cylindrical waves, from which transmitting boundary conditions are found. The theory requires only that the material near the transmitting boundary be elastic; inelastic material is possible inside the region. The numerical procedures are worked out in detail for application of both plane wave and cylindrical wave approximations to obtain two models of a transmitting boundary used in conjunction with a lumped parameter model. Special methods are required for the treatment of the boundary conditions at the intersections of a transmitting boundary. The examples demonstrate that the cylindrical wave transmitting boundary gives almost perfect transmission. In the case of a plane wave transmitting boundary, good results are obtained deep inside the region of interest.
Dissert. Abstr.

N76-28443 British Broadcasting Corp., Kingswood (England). Research Dept.
A VHF MULTIPATH SIMULATOR
D. E. Susans Jun. 1976 12 p refs
(BBC-RD-1976/13) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A description is given of a VHF multipath simulator intended for use in laboratory comparisons between different VHF sound transmission systems such as standard FM, wide deviation FM and PSK systems. Provision is made for generating single or multiple echoes with delays of up to 100 microseconds and, for some modulation systems, adjacent or co-channel interference can also be simulated. This equipment is a valuable tool for comparing different systems, but it must be regarded as complementing rather than replacing field trials which remain the only way of taking into account the nature and extent of the reflections which occur in practice. Author

N76-28444 British Broadcasting Corp., Kingswood (England). Research Dept.
THE TRANSMISSION OF TWO PROGRAMMERS FROM BAND II FM TRANSMITTERS: AN ASSESSMENT OF STORECASTING
D. J. Whythe Jun. 1976 18 p refs
(BBC-RD-1976/14) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

After a general discussion of the transmission and reception, by means of a subcarrier, of a subsidiary program ('storecasting') from Band II FM transmitters, the results of three field trials are given. For two of the trials the main program was monophonic, whereas for the third it was stereophonic. The subsidiary program was monophonic for all three trials. It was found that, when using a 67 kHz subcarrier, the subsidiary program could be radiated without causing undue impairment to main program reception for the great majority of present day listeners, provided the main program was monophonic. When the main program was stereophonic however, the subsidiary program was found to cause severe impairment to main program reproduction by the majority of current stereo receivers. Author

N76-28445 California Univ., Berkeley.
A UNI-MOMENT TECHNIQUE FOR THE SOLUTION OF RADIATION AND SCATTERING PROBLEMS INVOLVING INHOMOGENEOUS MEDIA Ph.D. Thesis
Robert Eugene Stovall 1975 93 p
Avail: Univ. Microfilms Order No. 76-15378

Except for the most trivial cases, antenna radiation and scattering problems involving inhomogeneous media escape analytical solution. For these problems a uni-moment technique is investigated applying it to general scattering problems and to the biconical antenna immersed in an inhomogeneous medium. The technique is used in conjunction with finite difference methods to analyze some dielectric loading schemes with the goal of improving performance of the biconical antenna. It is also formulated in terms of finite elements for the scattering problem. Results of experimental investigations on the biconical antenna bear out the validity of the technique. Dissert. Abstr.

N76-28446 Catholic Univ. of America, Washington, D.C.
DECISION-DIRECTED MODIFIED QUASI-BAYES ESTIMATION AND TRACKING OF THE NONSTATIONARY STOCHASTIC PARAMETERS OF A COMMUNICATION SIGNAL Ph.D. Thesis
Donald Michael Howe 1976 230 p
Avail: Univ. Microfilms Order No. 76-16241

The problem of estimating and tracking the signal parameters of a nonstationary stochastic Morse communication signal was investigated. The signal parameters are the characteristic element durations of the Morse message. A two dimensional estimation space is assumed containing six modes for the composite mark-space signal. Each mode is assumed to be an independent Gaussian bivariate probability density function on the basis of signal modeling using actual Morse data. Rapid convergence estimation, tracking and accurate transcription of the message contents are emphasized. The signal properties are studied using actual data. The estimation technique developed was a modified quasi-Bayes stochastic approximation procedure. Tracking was achieved through a smoothed measure of the signal data. The statistical estimates for each mode, together with knowledge of the language, were used to classify the message components. An error prediction procedure is developed based on the message parameter estimates for the beginning of the message.
Dissert. Abstr.

N76-28447 California Univ., Berkeley.
EXPERIMENTAL AND THEORETICAL STUDIES IN INFRARED RADIATION Ph.D. Thesis
Abdolali Hashemi 1975 121 p
Avail: Univ. Microfilms Order No. 76-15210

Expressions are derived for the absorption coefficient and the total band absorptance directly from the basic spectroscopic variables. The intensity relation used is valid for linear molecules and numerical and analytical results are obtained over a broad range of optical depths and pressures. In particular, comparison is made with the experimental data for the total band absorptance for carbon monoxide and nitric oxide and very good agreement is obtained. Analytic results for small and moderate values of the optical depth yield the well known linear and square root variations. At large optical depths and moderately large line

broadening, a square root logarithmic dependence is obtained. This result is consistent with the constant line spacing assumption that was made. Results are presented for measurements made of the infrared emission of carbon dioxide in the 2.7 micron region. Dissert Abstr.

N76-28448 California Univ., Berkeley.
INFRARED RADIATION FROM A GASEOUS-PARTICULATE MEDIUM Ph.D. Thesis
Richard Otto Buckius 1975 135 p
Avail: Univ. Microfilms Order No. 76-15125

Radiative transfer problems for gaseous-particulate medium are considered. A nongray anisotropic scattering problem is formulated for a homogeneous path. Mean scattering and absorption coefficients are defined to incorporate the nongray behavior and a simple approximate solution is presented. The incident intensity and the radiative heat flux are prescribed in terms of mean coefficients for the medium. The approximate results predict the surface incident intensity and radiative heat flux quite accurately. Gaseous and particulate absorption is considered for a nonhomogeneous medium. A simple peak partial pressure and peak temperature scaling method applicable to combustion zones is employed for nonhomogeneous intensity calculations. Natural diffusion flame radiation is investigated. Spectral measurements of the radiance and transmittance are reported for polystyrene, Delrin, and Plexiglas fuels. Nonhomogeneous path calculations are shown to be accurate and with the peak partial pressure and peak temperature scaling method, simple calculations are possible from fundamental properties of the flames. Dissert. Abstr.

N76-28449*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NEW OPTICAL AND RADIO FREQUENCY ANGULAR TROPOSPHERIC REFRACTION MODELS FOR DEEP SPACE APPLICATIONS
Allen L. Berman and Stephen T. Rockwell 1 Nov. 1976 37 p refs
(Contract NAS7-100)
(NASA-CR-148534; JPL-TR-32-1601) Avail: NTIS HC $4.00 CSCL 20N

The development of angular tropospheric refraction models for optical and radio frequency usage is presented. The models are compact analytic functions, finite over the entire domain of elevation angle, and accurate over large ranges of pressure, temperature, and relative humidity. Additionally, FORTRAN subroutines for each of the models are included. Author

N76-28450*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY AND SIMULATION OF SPATIAL VIDEO COMPRESSION FOR REMOTELY PILOTED VEHICLES
S. Knauer Jan. 1976 23 p refs
(NASA-TM-X-73137; A-6615) Avail: NTIS HC $3.50 CSCL 17B

Techniques of video compression applicable to remotely piloted vehicles (RPVs) are investigated. One approach is to reduce the frame rate, the other is to reduce the number of bits per sample needed to represent static picture detail by means of digital video compression. Hadamard transforms of 8 x 8 subpictures, with adaptive and nonadaptive quantization of transform coefficients, were investigated for the latter technique. Tapes of typical RPV video, processed by Aeronautronic Ford to simulate four frame rates, were again processed by the Ames real-time video system to obtain a variety of compressions of each of the four frame rates. Author

N76-28451# Civil Aeromedical Inst., Oklahoma City, Okla.
MASSED VERSUS DISTRIBUTED PRACTICE IN LEARNED IMPROVEMENT OF SPEECH INTELLIGIBILITY
Jerry V. Tobias Mar. 1976 9 p refs
(AD-A024705/6; FAA-AM-76-3) Avail: NTIS HC $3.50 CSCL 17/2

For the purpose of evaluating the process by which student pilots or new air traffic controllers learn to understand noisy and distorted communications, two experiments were conducted. For the first experiment, subjects were divided into five groups: One was permitted 2 minutes of listening practice; another, 4; another, 8; another, 16; and the other, 32. Retests 2 weeks later showed intelligibility improvement as a function of the number of minutes of previous experience up to 16; the 2- and 4-minute subjects appeared to be no different from subjects with no previous experience; 8-minute subjects were somewhat better; 16-minute subjects were much better; and 32-minute subjects were indistinguishable from those with a full hour of experience. Subjects for the second experiment were similarly divided except that each one returned to the laboratory three times a week until every listener had heard 32 minutes of distorted speech. The five groups were nearly indistinguishable from each other. Author

N76-28452*# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.
RADAR IMAGING FROM A SPINNING SPACECRAFT Final Report, 1 May - 1 Dec. 1975
Robert W. Bayma and Mohamed A. Hidayet Mar. 1976 92 p refs
(Contract NAS2-8860)
(NASA-CR-137829; ERIM-115200-2-F) Avail: NTIS HC $5.00 CSCL 17I

The feasibility of imaging the surface of Venus using a synthetic aperture radar in a spin stabilized Pioneer class spacecraft operating in an eccentric orbit is studied. Imaging radar fundamentals, constraints, power requirements and data processing considerations are reviewed. Additional effects due to operation from an elliptical orbit with a spinning spacecraft are covered. Recommended spin parameters are determined by simulations. Extensions to include noncoherent integration and stereo coverage are briefly reviewed. The results indicate that resolution on the order of 100 meters can be obtained from a 0.2 eccentricity orbit using a 2 meter antenna and reasonable transmitter power levels. Author

N76-28453*# Kanner (Leo) Associates, Redwood City, Calif.
STUDIES OF RADIOWAVE PROPAGATION IN THE SOLAR SYSTEM
M. A. Kolosov and O. I. Yakovlev Washington NASA Aug. 1976 33 p refs Transl. into ENGLISH from the book "Rasprostraneniye Radiovoln' Moscow, Nauka Press, 1975 p 291-311
(Contract NASw-2790)
(NASA-TT-F-17128) Avail: NTIS HC $4.00 CSCL 20N

A review is given of studies of radiowave propagation in the solar system that were conducted from 1963 to 1973 with the Soviet Spacecraft Venera, Mars, and Luna. Results are presented for satellite radio occultation investigations of the Martian atmosphere. Properties of radiowave propagation in the dense atmosphere of Venus, involving a radio link with descending spacecraft, are examined along with the basic characteristics of the scattering of satellite-emitted radio waves from the lunar surface. Studies of the propagation of monochromatic radiowaves in the solar plasma are reviewed, and investigations carried out in the United States with the Mariner, Pioneer, and Explorer spacecraft are discussed. Author

N76-28454*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
ON SIGNAL DESIGN BY THE R SUB 0 CRITERION FOR NON-WHITE GAUSSIAN NOISE CHANNELS
Dennis Lee Bordelon 28 Jul. 1976 46 p refs
(Grant NsG-5025)
(NASA-CR-148532; TR-EE-768) Avail: NTIS CSCL 17B

The use of the R sub 0 criterion for modulation system design is investigated for channels with non-white Gaussian noise. A signal space representation of the waveform channel is developed, and the cut-off rate R sub 0 for vector channels with additive nonwhite Gaussian noise and unquantized demodulation is derived. When the signal unput to the channel is a continuous random vector, maximization of R sub 0 with constrained average signal energy leads to a water-filling interpretation of optimal energy distribution in signal space. The necessary condition for a finite signal set to maximize R sub 0 with constrained energy and an equally likely probability assignment of signal vectors is presented, and an algorithm is outlined for numerically computing the optimum signal set. A necessary condition on a constrained energy, finite signal set is found which maximizes a Taylor series approximation of R sub 0.

This signal set is compared with the finite signal set which has the water-filling average energy distribution. Author

N76-28455# Naval Research Lab., Washington, D.C.
EXCITATION OF ELECTROMAGNETIC WAVES FROM A ROTATING ANNULAR RELATIVISTIC E-BEAM Interim Report
Phillip Sprangle Jan. 1976 31 p refs
(NRL Proj. R08-59)
(AD-A021402; NRL-MR-3209) Avail: NTIS CSCL 20/14

Propagation of a thin rotating relativistic electron beam through a circular waveguide is shown to excite both the transverse electric and transverse magnetic modes of the guide. The beam is guided by and rotates symmetrically about a constant uniform external magnetic field. Both the synchronous and cyclotron modes associated with the beam can interact with either waveguide mode to excite electromagnetic radiation. The dispersion relations for the four coupling processes are derived and analyzed. Finally, application of this mechanism to the generation of intense microwave radiation is discussed in the light of recent experiments. GRA

N76-28456# Federal Aviation Administration, Oklahoma City, Okla. Aeronautical Center.
ATMOSPHERIC ELECTRICITY PROTECTION FOR ELECTRIC AND ELECTRONIC SYSTEMS - RECOMMENDED PRACTICES
J. A. Davis Dec. 1975 23 p refs
(AD-A019152; FAA-TR-AAC-213-15) Avail: NTIS CSCL 17/2

Lightning strikes to aircraft produce transient currents on skin surfaces and occasionally induce transient currents in the electrical and electronic systems' wiring. Atmospheric electricity also includes static discharge which can affect the safety of an aircraft by degrading the electrical/electronic systems: performance at a time when atmospheric conditions are severe and these systems are most needed for instrument flight procedures. The paper presents recommended practices for the evaluation of system protection from the effects of atmospheric electricity. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-28457 Rutgers Univ., New Brunswick, N.J.
A STUDY OF SECOND HARMONIC POWER AMPLIFICATION IN TRAPATT DEVICES Ph.D. Thesis
Pang-Ting Ho 1976 165 p
Avail: Univ. Microfilms Order No. 76-16405

A theoretical analysis of TRAPATT operation was derived which explains all physical processes of the TRAPATT mode and shows the physical origin of the high efficiency operation. The electrical and thermal design criteria of the TRAPATT diode are discussed. A novel cruciform diode structure was fabricated using ion implantation techniques, which double the thermal handling capability of the device with greater reliability. Different TRAPATT amplifier circuits were designed and tested. The circuit studies show that bandwidth limitation of the TRAPATT amplifier is due to the circuit problem instead of the inherent properties of the device. The TRAPATT amplifier circuit impedances were measured by the automatic network analyzer up to the eighth harmonic of the fundamental trapped plasma frequency. Dissert. Abstr.

N76-28458 Oklahoma Univ., Norman.
NON-UNIFORMLY SAMPLED RECURSIVE DIGITAL FILTERS Ph.D. Thesis
Cyril Okeleke Anazia 1975 154 p
Avail: Univ. Microfilms Order No. 76-15793

The analysis and design is presented of recursive digital filters synchronously sampled nonuniformly, employing Z-transforms, Fourier transforms, and subsequently the state-space formulation. Suitable transfer sequence operators are developed for first and second order digital filters. Characteristic features of such transfer sequence operators are shown. Statistical analysis of the quantization effects due to round-offs are examined. A deterministic study of limit cycles due to roundoff of products in fixed-point arithmetic implementation is performed. Characteristic properties, such as stability constraints, magnitude and phase response of nonuniformly first and second order digital filters are presented and compared (using computer simulations) to those of the conventional digital filters. Application of the developed nonuniform sampling decomposition methods, particularly to recursive variable digital filters and also to digital filtering in radar systems, is presented with examples. Dissert. Abstr.

N76-28459 Arizona State Univ., Tempe.
THE PREPARATION OF ELECTRODELESS DISCHARGE LAMPS OF ARSENIC, ANTIMONY, GERMANIUM AND SELENIUM USING THEIR COVALENT HYDRIDES AS THE SOURCE OF ANALYTE Ph.D. Thesis
Glenn Edward Bentley 1976 135 p
Avail: Univ. Microfilms Order No. 76-14748

Electrodeless discharge lamps were prepared for arsenic, antimony, germanium, and selenium using the covalent gaseous hydride of each of the elements as the source of the analyte. The method for lamp preparation was optimized and lamp characteristics were thoroughly investigated. Lamps that were prepared using the hydride technique were shown to be intense, stable, reproducible, and reliable. This method provides the potential for practical commercial production of microwave excited electrodeless discharge lamps for all of the elements that form volatile hydride compounds. Dissert. Abstr.

N76-28460 Wisconsin Univ., Madison.
IMPROVEMENT OF POWER SYSTEM TRANSIENT STABILITY USING OPTIMAL CONTROL OF NETWORK PARAMETERS Ph.D. Thesis
Abdelrahman Tawfig Hamad 1975 180 p
Avail: Univ. Microfilms Order No. 76-8587

The problem of restoring a power system to a steady state condition in minimum time and in a nonoscillatory trajectory following the occurrence of a malfunction is identified as a time-optimal control problem. Application of bang-bang manipulation of network reactance to satisfy Pontryagin's minimum principle is used. Control strategies are developed to steer the state variables from those values unstable initial condition to the desired pre-calculated values at the final stable condition. Proper guidance of all the state variables improves the transient stability limit permitting an increase in the transmission line capability. The implementation of this method on a sample power system is shown along with numerical results. In addition the transient overvoltages in the system and across the inserted control elements caused by switching operations are calculated and found to be well within safe limits. Hence the proposed control can be practically implemented with present-day technology. Dissert. Abstr.

N76-28461 California Univ., Berkeley.
SEMICONDUCTOR-BARRIER JOSEPHSON JUNCTIONS FOR HIGH SPEED DIGITAL CIRCUITS Ph.D. Thesis
Wing Yat Lum 1975 143 p
Avail: Univ. Microfilms Order No. 76-15289

The use of the semiconductor-barrier Josephson junction as the switching component in high-speed digital circuits is reported. The switching time of a single superconducting lead-tellurium-lead (Pb-Te-Pb) junction and the current transfer time of a memory cell using such a device as the logic switch is measured. The shortest switching time of a rather large junction is 67 ps and the current transfer time of a memory cell with loop inductance is 350 ps. These measured values are comparable with those obtained for oxide tunnel junctions with similar dimensions. Computer simulations are performed of the switching behavior of both the single junction and the memory cell. Theoretical results are in good agreement with the experimental measurements. A simple cavity model is used to analyze the self-resonances in semiconductor-barrier Josephson junctions. The

cavity Q is approximately two orders of magnitude lower than that of comparable oxide tunnel junctions due to the higher damping in the semiconductor-barrier region. Dissert. Abstr.

N76-28462 Rutgers Univ., New Brunswick, N.J.
TRANSPORT DIELECTRIC AND SWITCHING PROPERTIES OF NiO AND NiO(LI) THIN FILMS IN THE DEVICE CONFIGURATION OF Ni-NiO-Ni Ph.D. Thesis
Bernard Chung Wai Leung 1976 164 p
Avail: Univ. Microfilms Order No. 76-16410

The transport and dielectric properties in thin polycrystalline films of NiO are investigated as functions of doping, temperature, frequency, and voltage using evaporated nickel contact electrodes. Conduction states due to successive dielectric breakdown are observed: (1) the initial high resistance state, which exhibits parabolic dependence of conductivity on the applied field; (2) the second lower resistance state with avalanche characteristics displaying current controlled negative resistance; (3) the third or nearly ohmic state; and (4) the final ohmic state corresponding to irreversible dielectric breakdown. The transition between the first and third or second and third states is reversible, showing cyclic switching behavior and voltage-dependent delay times. The life-time of this switching device is found to be dependent on the efficiency of the heat exchange-between the device and the substrate. A surface switching device configuration is designed which improves this efficiency. Dissert. Abstr.

N76-28463 California Univ., Berkeley.
MASS TRANSFER IN ROTATING ELECTRODE SYSTEMS Ph.D. Thesis
Charles Milton Mohr 1975 138 p
Avail: Univ. Microfilms Order No. 76-15317

An improved method of solution for the hydrodynamics of a rotating disk employing a series-matching technique is presented. The limiting current mass transfer characteristics of a rotating disk electrode with an offset center of rotation are treated via identification of certain behavior analogous to ring-disk and ring electrode systems, mass transfer rates are calculated as a function of the amount of offset employing a numerical technique, and an analytic asympotic model for large offsets is developed. An experimental study of the diffusion-limited rate of mass transfer to a rotating disk electrode in the transition region between the laminar and turbulent flow regimes is reported. An empirical correlation of the local and average current densities is derived. An experimental study of the mass transfer in turbulent flow between concentric cylinders, the inner of which is rotated, is presented. A numerical model based upon the concept of a universal eddy diffusivity profile for turbulent flows is derived and is shown to be inappropiate for this turbulent flow. Dissert. Abstr.

N76-28464 Rochester Univ., N.Y.
INJECTION-LOCKING PHENOMENA IN JOSEPHSON OSCILLATORS Ph.D. Thesis
Charles Vincent Stancampiano 1976 195 p
Avail: Univ. Microfilms Order No. 76-14789

The term injection locking refers to a process in which a powerful but noisy oscillator is frequency pulled and phase locked by a weak injected signal at a nearby frequency. Experimental evidence is presented demonstrating that a Josephson oscillator, consisting of a superconducting point-contact junction mounted in a coaxial resonator, exhibits those properties characteristic of an injection-locked oscillator, and can be described by well-known theories of oscillator synchronization. Dissert. Abstr.

N76-28465 Cornell Univ., Ithaca, N.Y.
PROPERTIES AND MECHANISMS OF METAL-INSULATOR-METAL POINT-CONTACT INFRARED DIODE DETECTORS Ph.D. Thesis
Bor-Long Mike Twu 1975 90 p
Avail: Univ. Microfilms Order No. 76-15399

Detection mechanisms of Metal-Insulator-Metal (MIM) Point-Contact diodes at 10.6 micron wavelength were studied. Radiation patterns were obtained experimentally and interpreted by means of a simple theory. It is concluded that the diode acts as an efficient optical antenna-load combination and detects by virtue of a nonlinear current-voltage characteristic that retains its character over the entire frequency range from dc to 3 x 10 to the 13th power Hz. Thus the optical diode behaves very much as an ordinary lumped circuit element. Dissert. Abstr.

N76-28466 North Carolina State Coll., Raleigh.
A UNIFIED APPROACH TO THE STATE AND OUTPUT ASSIGNMENT PROBLEM IN SYNCHRONOUS SEQUENTIAL MACHINES Ph.D. Thesis
Atul R. Jai 1975 181 p
Avail: Univ. Microfilms Order No. 76-14324

The design of sequential circuits is approached as a practical problem of efficiently generating the state and output encoding such that the solution is reasonably close to the optimum with respect to the cost of logic gates. Partition theory is used to formulate and solve the problem. A set of partitions is defined on the sets of states and outputs which are useful in making the state and output assignments, respectively. Using these partitions a lower bound on the amount of excitation logic required is computed separately for sequential circuits using delay, trigger, and J-K flip-flop memory elements. The results of lower bound computations are extended to include the cost of output logic. An algorithm for simultaneous generation of both state and output assignment successively iterates the generation, scoring, and selection of useful partitions such that the solution approaches the lower bound. It is applicable to sequential machines using delay, trigger, or J-K flip-flop memory elements. Dissert. Abstr.

N76-28467 Cornell Univ., Ithaca, N.Y.
SUCCESSIVE APPROXIMATION ANALOG-TO-DIGITAL CONVERSION TECHNIQUES IN MOS INTEGRATED CIRCUITS Ph.D. Thesis
James Leo McCreary 1975 224 p
Avail: Univ. Microfilms Order No. 76-15296

New methods of analog-to-digital conversion which are suitable for monolithic construction are studied. A new technique has been developed which utilizes charge redistribution among binary weighted capacitors. An experimental integrated circuit, fabricated to test the new approach performed analog-to-digital conversion in 23 micron with an accuracy of 10 bits + or - 1/2 of the least significant bit. Dissert. Abstr.

N76-28468 California Univ., Berkeley.
SINC-S: A COMPUTER PROGRAM FOR THE STEADY-STATE ANALYSIS OF TRANSISTOR OSCILLATORS Ph.D. Thesis
Shi Ping Fan 1975 265 p
Avail: Univ. Microfilms Order No. 76-15172

Program SINC-S incorporates Program SINC (SImulator for Nonlinear Circuits) and the Aprille-Colon-Trick (ACT) algorithm for nonlinear dc and time-domain transient and steady-state analyses of transistor circuits. The basic SINC program is a compact program using modified nodal analysis for dc and time-domain simulation of transistor circuits. In the simulation of relaxation oscillators, Gear's 2nd-order integration method with the solution-iteration-count time-step control is found to be most effective. The ACT algorithm finds initial conditions satisfying the periodicity requirement using Newton's method, with the Jacobian matrix obtained from the sensitivity circuits. In many applications, steady-state analysis using the ACT algorithm reduces the computation time by more than a factor of 3 over conventional time-domain transient analysis. Dissert. Abstr.

N76-28469 Carnegie-Mellon Univ., Pittsburgh, Pa.
GRAPH MODELING AND MODEL SIMPLIFICATION TECHNIQUES FOR FAULT ANALYSIS IN SEQUENTIAL SWITCHING CIRCUITS Ph.D. Thesis
William Andrew Boag, Jr. 1976 675 p
Avail: Univ. Microfilms Order No. 76-15970

An algorithmic procedure is developed which can be used to generate a special form of the Petri Net graphs, called a CFN Logic Model, which describes the functional behavior of a digital switching circuit. In order to represent the effects of physical faults in circuits, transformation procedures are developed which modify the structure of a CFN Logic Model. These structural modifications are defined such that the circuit behavior that is represented by a resulting CFN Fault Model has a one-to-one correspondence with the behavior of the actual faulty circuit. Methods are developed to estimate the structural complexity of a CFN Logic Model or Fault Model for a circuit as compared to

the complexity of the circuit logic schematic. Reduced forms of the CFN Fault Models are used to identify equivalence and covering relations between faults in digital switching circuits. This information is used to simplify any fault detection or fault diagnosis schemes that are derived for a switching circuit. Dissert. Abstr.

N76-28470*# Westinghouse Research Labs., Pittsburgh, Pa.
DEVELOPMENT AND FABRICATION OF IMPROVED POWER TRANSISTOR SWITCHES
P. L. Hower and C. K. Chu Feb. 1976 49 p refs
(Contract NAS3-18916)
(NASA-CR-135013) Avail: NTIS HC $4.00 CSCL 09A

A new class of high-voltage power transistors has been achieved by adapting present interdigitated thyristor processing techniques to the fabrication of NPN Si transistors. Present devices are 2.3 cm in diameter. The electrical performance obtained is consistent with the predictions of an optimum design theory specifically developed for power switching transistors. The forward safe operating area of the experimental transistors shows a significant improvement over commercially available devices. The report describes device design, wafer processing, and various measurements which include dc characteristics, forward and reverse second breakdown limits, and switching times. Author

N76-28471*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POWER FACTOR CONTROL SYSTEM FOR ac INDUCTION MOTORS Patent Application
Frank J. Nola, inventor (to NASA) Filed 19 Jul. 1976 15 p
(NASA-Case-MFS-23280-1; US-Patent-Appl-SN-706425) Avail: NTIS HC $3.50 CSCL 09C

A power factor control system for use with ac induction motors is described. The device samples line voltage and current through the motor and decreases power input to the motor proportional to the detected phase displacement between current and voltage. It thereby provides less power to the motor, as it is less loaded. NASA

N76-28472*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID METAL SLIP RING Patent Application
Frank D. Berkopec, Robert R. Lovell, and David H. Culp, inventors (to NASA) Filed 26 Jul. 1976 11 p
(NASA-Case-LEW-12277-1; US-Patent-Appl-SN-708659) Avail: NTIS HC $3.50 CSCL 09A

A liquid metal slip ring is described which comprises a rotor in the form of a ring about an axis and a stator. The rotor is rotatable relative to the stator and has a channel in which the liquid metal is retained during operation by surface tension. The stator comprises a brush or probe which is partially immersed in the metal in the channel and is bidirectionally symmetrical. Whichever direction the rotor turns, the probe presents the same physical resistance and affords the same electrical conductivity as a connection between the probe and the rotor. NASA

N76-28473*# Ortec, Inc., Oak Ridge, Tenn.
NIM AND CAMAC MODULE STUDIES Final Report, 1 Nov. 1975 - 15 Mar. 1976
J. Frank Pierce 15 Mar. 1976 16 p
(Contract NAS5-22812)
(NASA-CR-144785) Avail: NTIS HC $3.50 CSCL 09C

The feasibility of adapting two NIM and two CAMAC modules for space research was studied. Methods are outlined for reducing the power in each module by approximately fifty percent. Components that could not be replaced from the NASA approved component list are identified. Special problems associated with grounding, vacuum operation, temperature variations, vibration and shock are outlined. Suggested solutions for these problems are discussed. Author

N76-28474*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIATION DESIGN CRITERIA HANDBOOK
Alan G. Stanley, Keith E. Martin, and Sandra Douglas 1 Aug. 1976 349 p refs
(Contract NAS7-100)
(NASA-CR-148510; JPL-TM-33-763) Avail: NTIS HC $10.00 CSCL 20N

Radiation design criteria for electronic parts applications in space environments are provided. The data were compiled from the Mariner/Jupiter Saturn 1977 electronic parts radiation test program. Radiation sensitive device types were exposed to radiation environments compatible with the MJS'77 requirements under suitable bias conditions. A total of 189 integrated circuits, transistors, and other semiconductor device types were tested. Author

N76-28475*# McDonnell-Douglas Astronautics Co., Houston, Tex. Astronautics Div.
SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT. ISOLATION BETWEEN THE S-BAND QUAD ANTENNA AND THE S-BAND PAYLOAD ANTENNA. ENGINEERING SYSTEMS ANALYSIS
J. F. Lindsey 12 Jul. 1976 25 p refs
(Contract NAS9-14960)
(NASA-CR-147835; Rept-1.2-DN-B0503-006) Avail: NTIS HC $3.50 CSCL 09C

The isolation between the upper S-band quad antenna and the S-band payload antenna on the shuttle orbiter is calculated using a combination of plane surface and curved surface theories along with worst case values. A minimum value of 60 db isolation is predicted based on recent antenna pattern data, antenna locations on the orbiter, curvature effects, dielectric covering effects and edge effects of the payload bay. The calculated value of 60 db is significantly greater than the baseline value of 40 db. Use of the new value will result in the design of smaller, lighter weight and less expensive filters for S-band transponder and the S-band payload interrogator. Author

N76-28476# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
ISLAND EDGE EFFECTS IN CMOS/SOS TRANSISTORS
S. N. Lee, R. A. Kjar, and G. Kinoshita Mar. 1976 26 p refs
(X76-367/501) Avail: NTIS HC $4.00

The physical and electrical properties of CMOS/SOS silicon island edges are investigated. Roughness of etched surfaces, non uniform crystalline quality, and doping level along island edge surfaces, and the formation of V grooves after thermal oxidation of silicon islands are related to leakage currents and other undesirable electrical characteristics. Oxide charges at the edge and the top surfaces, body doping level, and body bias effect due to the floated substrate are analyzed with respect to early turn-on of the edge channel in n-channel transistors. Finally, SOS transistors with various edge configurations, such as the conventional island, oxide protected, edge-channel stop, and edgeless transistors are studied to confirm the analysis experimentally. Author

N76-28477# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
INVESTIGATION AND MODELING OF 'KINK' RELATED PHENOMENA IN n-CHANNEL MOS/SOS TRANSISTORS
John G. Poksheva 21 May 1976 35 p refs
(X76-645/550) Avail: NTIS HC $4.00

Kink related phenomena, strongly manifest in the electrical characteristics of heavily-doped MOS silicon-on-sapphire (SOS) transistors, are investigated. The Kink in drain current-voltage characteristics and snap-action behavior in drain current-gate voltage characteristics are analyzed and modeled in terms of an expanded form of the Baum drift velocity saturation formulation. The impact of these phenomena upon CMOS/SOS inverter characteristics is also explored. Model predictions are compared with experimental results over a broad range of operating conditions. Satisfactory agreement with experimental data is demonstrated for the model. Author

N76-28478# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
THREE-db COPLANAR COORDINATES
M. H. Arain, N. W. Spencer, and D. W. Ball 10 Jun. 1976 11 p refs
(X76-629/201) Avail: NTIS HC $3.50

The designs of a two-strip coplanar and a four-strip (interdigital) coplanar couplers are described. The characteristics impedances and phase velocities as calculated by the relaxation method are shown. Performance data for both couplers are presented. Author

N76-28479*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PREDICTION AND MEASUREMENT OF RADIATION DAMAGE TO CMOS DEVICES ON BOARD SPACECRAFT

R. A. Cliff, V. Danchenko, E. G. Stassinopoulos, M. Sing, G. J. Brucker (Radio Corp. of America, Princeton, N. J.), and R. S. Ohanian (Radio Corp. of America, Princeton, N.J.) Jul. 1976 42 p refs Submitted for publication

(NASA-TM-X-71166; X-700-76-155) Avail: NTIS HC $4.00 CSCL 09C

The initial results obtained from the Complementary Metal Oxide Semiconductors Radiation Effects Measurement experiment are presented. Predictions of radiation damage to C-MOS devices are based on standard environment models and computational techniques. A comparison of the shifts in CMOS threshold potentials, that is, those measured in space to those obtained from the on the ground simulation experiment with Co 60, indicated that the measured space damage is greater than predicted by a factor of two for shields thicker than 100 mils (2.54 mm), but agrees well with predictions for the thinner shields. Author

N76-28480# Scientific Translation Service, Ann Arbor, Mich.

SIMPLIFIED THEORY OF HIGH EFFICIENCY INDUCTIVE TRANSFER PROCESSES

C. Rioux Mar. 1975 12 p refs Transl. into ENGLISH from Rev. Phys. Appl. (Paris), v. 10, no. 2, Mar. 1975 p 75-79 Sponsored by ERDA

(ANL-Trans-1022) Avail: NTIS HC $4.50

A system using only inductances and opening and closing switches has been developed to transfer energy from a storage inductance to any given load with a very high efficiency. Even higher efficiencies can be achieved if a number of small capacitors is used. Author (ERA)

N76-28481# Los Alamos Scientific Lab., N.Mex.

HIGH VOLTAGE, HIGH CURRENT, PULSED ENERGY SOURCE HAVING dI/dt's OF 2 TIMES 10 TO THE 12TH POWER A/s

L. C. Burkhardt, R. S. Dike, J. N. Dimarco, R. A. Haarman, and A. E. Schofield 1975 4 p refs Presented at the 6th IEEE Symposium on Engineering Problems of Fusion Research, San Diego, Calif., 18-21 Nov. 1975

(Contract W-7405-eng-36)

(LA-UR-75-2129; Conf-751125-51) Avail: NTIS HC $4.50

A hybrid transfer capacitor circuit, combining one back-biased and a forward-biased capacitor bank, plus a resistor (for damping and isolation) and an inductive load has achieved inductive-storage, explosive fuse-like rates of rise, and peak amplitudes, of currents. The combination of explosive fuses and magnetic energy storage was successfully used to obtain currents with risetimes of 2 x 10 to the 12th power A/s and of 200 kA magnitude, on both linear and toroidal Z pinches. Such a system must have the characteristic of initially high vector E fields during the formation of the pinch, but with low vector E fields along the plasma chamber's wall after the pinch was formed. The voltage left on a simple capacitor system will cause secondary wall breakdown, which short-circuits the previously formed pinch. Author (ERA)

N76-28482# Los Alamos Scientific Lab., N.Mex.

DIAGNOSIS OF UNDERDRYING IN PAPER CASTOR OIL CAPACITORS

G. P. Boicourt 1975 8 p refs Presented at 6th IEEE Symposium on Engineering Problems of Fusion Research, San Diego, Calif., 17 Nov. 1975

(Contract W-7405-eng-36)

(LA-UR-75-2128; Conf-751125-54) Avail: NTIS HC $4.50

Underdrying of the Kraft paper insulant in energy-storage capacitors can drastically shorten their life and even make them unsuitable for certain applications. When an underdryed capacitor fails in such an application, the user is often at a loss to know the reason since the diagnosis of underdrying is not an easy one to make. Margin spotting and margin arcs, two diagnostic clues, are discussed as is the empirical evidence connecting them to underdrying. Photographs showing their physical appearance are presented. A theoretical explanation is given which connects their presence to underdrying. Author (ERA)

N76-28483# California Univ., Livermore. Lawrence Livermore Lab.

CALCULATION OF ELECTROMAGNETIC FIELDS AND FORCES IN COIL SYSTEMS OF ARBITRARY GEOMETRY

S. J. Sackett 14 Nov. 1975 7 p refs Presented at the 6th IEEE Symp. on Eng. Probl. of Fusion Res., San Diego

(Contract W-7405-eng-48)

(UCRL-77244; Conf-751125-11) Avail: NTIS HC $4.50

A computer program is described which calculates the electric and magnetic fields due to an arbitrary spatial distribution of current carrying circular loops, circular arcs, and straight lines. The electric field is assumed to arise solely from the time variation of the magnetic field, and the magnetic field due to the changing electric field is assumed to be negligible. In addition, the conductor bundle elements (loops, arcs, lines) are assumed to be absent. Electric and magnetic flux lines and magnetic forces and inductances are also calculated. The algorithm used in the code, which is based on a combination of direct and numerical integration using the Biot Savart law, is discussed. The methods used to maintain accuracy in calculating fields within the conductor bundle, in particular, are detailed. Several examples are then presented to illustrate the input and output features as well as the accuracy obtained and the running time required. Author (ERA)

N76-28484# Martin Marietta Aerospace, Orlando, Fla.

STANDARDIZATION ENGINEERING PRACTICES STUDY FOR PRINTED WIRING BOARD AND ASSEMBLY DEFECTS GUIDE AND CONFORMAL COATINGS PROBLEM AREAS Final Report, May 1974 - Apr. 1975

Walter S. Rigling Oct. 1975 116 p

(Contract DAAB07-73-C-0191)

(AD-A020486; OR-13725; ECOM-0191-F-73) Avail: NTIS CSCL 09/5

The purpose of this program was to develop a military standard that contained corrective action guide data for printed wiring board and assembly defects and to develop test data from which revision drafts to MIL-I-46058 could be written. This report describes the accomplishments of the final portion of the program. It also includes major portions of effort completed in previous semiannual portions of the program. The complete results of all contract goals are provided with emphasis placed on reversion, service temperature, and buffer material analysis. The Phase I portion is provided as an appendix to this report and sets forth those features necessary to achieve the goals selected. The Phase II effort demonstrated that a quantitative test procedure could be developed that would measure change in properties of the various materials as they age or deteriorate under thermal and moisture conditions. The buffer material tests strongly indicate the need for buffer materials only if coating thicknesses are greater than 6 mils. Author (GRA)

N76-28485# Sperry Univac, St. Paul, Minn. Defense Systems Div.

FAULT SUPPRESSION IN A TREE OF GALOIS LINEAR MODULES

J. M. Marver Jan. 1976 28 p refs

(Contract N00014-75-C-0675)

(AD-A021161; PX-11552) Avail: NTIS CSCL 09/2

Galois logic design has application to fault tolerant technology. Test vectors and test sequences have been found which test all single and many multiple stuck-at faults in standard Galois linear modules with built-in parity check logic. A straightforward method provides fault detection, location, and suppression in galois linear modules arranged in a GF(2 the 4th power) tree network having single spares at each level. A single standard module with input multiplexers for test selection and spare selection can be replicated with very minimal additional logic to form a complete linear tree having a high degree of fault tolerance. Author (GRA)

N76-28486# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

HEURISTIC TECHNIQUES IN COMPUTER AIDED CIRCUIT ANALYSIS

Gerald J. Sussman Mar. 1975 28 p refs

(Contract N00014-70-A-0362-0005)

(AD-A021171; AI-M-328) Avail: NTIS CSCL 09/2

Whereas other circuit analysis systems rely on classical, formal analysis techniques, EL employs heuristic inspection methods to solve rather complex dc bias circuits. These techniques also give EL the ability to explain any result in terms of its own qualitative reasoning processes. EL's reasoning is based on the concept of a local one-step deduction augmented by various teleological principles and by the concept of a macro-element. Several annotated examples of EL in operation and an explanation of how it works were presented. Also how EL can be extended in several directions, including sinusoidal steady state analysis were discussed. EL is significant not only as a novel approach to circuit analysis but also as an application of Artificial Intelligence techniques to a new and interesting domain. GRA

N76-28487# ITT Electron Tube Div., Easton, Pa.
SEALED BEAM XENON LAMP Final Technical Report
J. Malloy and J. Hilton Oct. 1975 56 p
(Contract DAAK02-75-C-0047; DA Proj. 157-63719-DK-70) (AD-A020853; ITT-1049.13) Avail: NTIS CSCL 13/1

The purpose of the program was to demonstrate the achievement of a capability for producing 1.0 kilowatt sealed beam xenon lamps. The sealed beam xenon lamp is a pressurized optical device consisting of a pair of electrodes, an optical window, a reflector, and a metal ceramic body. The cathode electrode is made of thoriated tungsten and the anode is fabricated from pure tungsten bar. The lamp has an integral reflector, the position of which is optimized for maximum light output through the sapphire window. The lamps built during this contract require a high voltage pulse for ignition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N76-28488 Texas Univ., Austin.
SHAPES OF DROPS IN CENTRIFUGAL FIELDS AND THEIR UTILIZATION FOR LOW INTERFACIAL TENSION INVESTIGATIONS Ph.D. Thesis
John Leland Cayias 1975 112 p
Avail: Univ. Microfilms Order No. 76-14422

A method for measuring interfacial tensions, called the spinning drop technique, that is especially applicable to low interfacial tension measurements was developed. The method is based on measuring the shape of a drop profile which is deformed by a centrifugal force field. The solution to the problem of determining the drop shape was shown to be unique and was applied to measuring interfacial tensions between hydrocarbons and water utilizing petroleum sulfonate surfactants. Well defined conclusions were formed in perusing the data, correlating the molecular weight of the hydrocarbon in a homologous series and the equivalent weight of the surfactant. Dissert. Abstr.

N76-28489 California Univ., Berkeley.
A KINETIC THEORY APPROACH TO THE UNSTEADY FLOW OF NON-NEWTONIAN FLUIDS Ph.D. Thesis
Armand Victor Attia 1975 123 p
Avail: Univ. Microfilms Order No. 76-15101

The Maxwell-Boltzmann kinetic theory is used to study the unsteady flow of a gas, tending to equilibrium. A large total specific energy or high temperature rates imply that the kinetic gas behaves as a non-Newtonian fluid, such as the Rivlin-Ericksen fluid. The motion studied contains a spatial restriction which is consistent with basic field equations. The particular motion studied is skew, rectilinear, viscometric motion. By invoking certain invariance principles of constitutive theory in continuum mechanics, Maxwell's equations of transfer were reduced to ordinary differential equations. These equations were then applied to techniques developed by Ikenberry and Truesdell to obtain approximate constitutive relations for the shear stress. Putting this latter result into the conservation laws yielded the time dependent part of the motion, the pressure and temperature. Dissert. Abstr.

N76-28490 Rutgers Univ., University Park, N.J.
MATHEMATICAL SIMULATION OF UNSTEADY FLOWS AND THE MECHANICS OF DISPERSION IN ESTUARIES Ph.D. Thesis
Fehmi Numan Aydin 1976 376 p
Avail: Univ. Microfilms Order No. 76-16383

A two dimensional simulation of Delaware estuary hydrodynamics has been constructed. This simulation has been achieved through a rational estimate of the character of natural turbulence. Nonhomogeneous velocities, on the cross section, are employed in two dimensional, laterally homogeneous species mass balances. In turn, concentration profiles are interpreted in the form of classical, one dimensional dispersion coefficients. Variation of dispersion as a function of both fresh water inflow and longitudinal distance was generated. Variation of dispersion in time within a tidal cycle was found to be insignificant for most of the sections under study while no significant variation from one tidal cycle to the next has been detected. In addition to the predictions of real time dispersive processes, the solution of two dimensional species mass balances were shown to guide detection, monitoring and recovery practices. Dissert. Abstr.

N76-28491 Utah Univ., Salt Lake City.
AN EXPERIMENTAL STUDY OF UNSTEADY TURBULENT FLOWS Ph.D. Thesis
Phone-Nan Wang 1976 140 p
Avail: Univ. Microfilms Order No. 76-15576

In the wind tunnel, a fully-developed turbulent pipe flow is almost linearly accelerated or decelerated from one stationary stage to another stationary stage. The structure of unsteady turbulent boundary layer is characterized by the combined ensemble and short-time average estimates of the mean motion, the turbulent intensities and the Reynolds stress. The spectral structure of unsteady turbulence is presented with segment spectrum, physical spectrum, instantaneous spectrum and the evolutionary spectrum. Those spectral calculation schemes are first tested by a computer simulated nonstationary random process. It is found that the structures of unsteady turbulent flows (except the radical turbulent intensity) depend upon the history of nonstationary process characterized by the generalized Strouhal number. The longitudinal turbulent intensity and Reynolds stress generally increase with the absolute value of Strouhal number. Dissert. Abstr.

N76-28492 California Univ., Berkeley.
THE STOKES EQUATIONS IN Lp Ph.D. Thesis
Marjorie Frost McCracken 1975 62 p
Avail: Univ. Microfilms Order No. 76-15295

The Stokes equations, which are the linearization (about zero) of the equations of motion of a viscous, incompressible fluid, are studied. The main result is that the Stokes equations generate an analytic semigroup on the range of the Hodge projection. Dissert. Abstr.

N76-28493 California Univ., Berkeley.
A NUMERICAL STUDY OF TURBULENT DIFFUSION Ph.D. Thesis
Michel Gregory McCoy 1975 112 p
Avail: Univ. Microfilms Order No. 76-15293

The problem of the numerical simulation of turbulent diffusion is studied. The two dimensional velocity fields are assumed to be incompressible, homogeneous and stationary, and they are represented as stochastic processes. A technique is offered which creates velocity fields accurately representing the input statistics once a two point correlation function or an energy spectrum is given. Various complicated energy spectra may be represented utilizing this model. The program is then used to extract information concerning Gaussian diffusion processes. Various theories of other workers are tested including Taylor's classical representation of dispersion for times long compared with the Lagrangian correlation time. Also, a study is made of the relationship between the Lagrangian and the Eulerian correlation function and a hypothesis is advanced and successfully tested. Questions concerning the relationship between small eddies and the energy spectrum are considered. A criterion is advanced

and successfully tested to decide whether small scale flow can be detected within the large eddies for any given spectrum. A method is developed to determine whether this small scale motion is in any sense periodic. Finally, the relationship between two particle dispersion and the energy spectrum is studied anew and various theories are tested. Dissert. Abstr.

N76-28494 California Univ., Davis.
THREE-DIMENSIONAL GALERKIN-FINITE ELEMENT FORMULATION OF FLOW AND MASS TRANSPORT THROUGH POROUS MEDIA Ph.D. Thesis
Sumant Kumar Gupta 1975 174 p
Avail: Univ. Microfilms Order No. 76-14208

The capability of a three-dimensional model developed was demonstrated by applying it to a real world ground-water system of complex geometry, material characteristics, and initial and boundary conditions. The model uses three-dimensional isoparametric elements that can be deformed in x, y, and z directions to handle any type of multi-aquifer geometry in a most economical manner, i.e., higher-order elements are required for curved boundaries and lower-order for the rest of the region. Material properties can be changed abruptly from element to element, or even within the element. Dissert. Abstr.

N76-28495 California Univ., Berkeley.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS AT HIGH REYNOLDS NUMBERS Ph.D. Thesis
Aleksei Ilyich Shestakov 1975 98 p
Avail: Univ. Microfilms Order No. 76-15369

A numerical method is presented which is designed to solve the Navier-Stokes equations for two-dimensional incompressible flow. The method is intended for use on problems with high Reynolds numbers for which calculations via finite difference methods have been unattainable or unreliable. The proposed scheme is a hybrid utilizing a time-splitting finite difference method in areas away from the boundaries. In areas neighboring the boundaries, the equations of motion are solved by the newly proposed vortex method by Chorin. The major accomplishment of the new scheme is that it contains a simple way for merging the two methods at the interface of the two subdomains. The proposed algorithm is designed for use on the time dependent equations but can be used on steady state problems as well. The method is tested on the popular, time-independent, square cavity problem, an example of a separated flow with closed streamlines. Numerical results are presented for a Reynolds number of 1000. Dissert. Abstr.

N76-28496 California Univ., Berkeley.
AN INVESTIGATION OF MOMENTUM AND HEAT TRANSPORT IN OSCILLATORY TURBULENT SUBCOOLED FLOW AND ITS IMPORTANCE IN THE ANALYSIS OF DENSITY WAVE OSCILLATIONS Ph.D. Thesis
Ramendra Prasad Roy 1975 195 p
Avail: Univ. Microfilms Order No. 76-15358

An experiment was set up to investigate transient, radial heat, and momentum transport effects. A sinusoidally modulated Refrigerant-113 flow (at frequencies ranging from 0.1 to 2 Hz) is passed through a test section consisting of an unheated hydrodynamic entrance length and a resistively heated (variable) length. A radially-traversing hot-film anemometer probe is introduced into the flow at the end of the heated length to measure, record, and analyze the time dependent velocity and temperature profiles. The data show a substantial radial dependence of both the amplitude and phase of the liquid temperature perturbations at frequencies as low as 0.1 Hz. Significant departures from the one-dimensional model predictions appear at frequencies as low as 0.3 Hz. The enthalpy-perturbation propagation, as predicted by the one-dimensional model, breaks down at frequencies above 0.5 Hz. The perturbations probably become increasingly dependent on very recent history, and on local wall effects, thereby losing axial dependence. Additional heat transport mechanisms generated by flow oscillation may also have significant effects. Dissert. Abstr.

N76-28497 Texas Univ., Austin.
A METHOD FOR BOUNDING IRREGULARLY-SHAPED RESERVOIR SUBJECT TO UNSTEADY STATE FLOW Ph.D. Thesis
Hong-Chen Lin 1975 171 p
Avail: Univ. Microfilms Order No. 76-14487

A bounding technique is developed for irregularly bounded system subject to unsteady-state fluid flow. The theory used is based on the well-known continuous line source solution. The principle of superposition was applied to generate the pressure behavior in the multiwell, multirate system. A mathematical streamline model was developed to study, first, the pressure approximations and the instantaneous streamline patterns in a bounded square reservoir with a well at the center, and a rectangular reservoir of two wells with different flow rates. Thus, results obtained by the proposed method were shown to be the same as those obtained from the method of image.
Dissert. Abstr.

N76-28498 Brown Univ., Providence, R.I.
ON THE EXPERIMENTAL DETERMINATION OF THE VISCOMETRIC FUNCTIONS Ph.D. Thesis
Walter Stehrenberger 1975 214 p
Avail: Univ. Microfilms Order No. 76-15721

A Couette viscometer with guard rings was built to investigate solutions with concentrations as low as 10 ppm. The main features of this calibrated instrument are temperature control to + or - 0.1 C and a possible accuracy of + or - 1%. The result of the investigation is the realization that an accurate determination of shear viscosity requires the application of the correct data reduction procedure which was first worked out by Krieger, Maron and Elrod. As a secondary result the influence on the measurement of the gaps between the torque sensing suspended cylinder and the guard rings is reported. The acting moment was found to increase in proportion to the dimensionless gap size. To include second order fluids a jet thrust apparatus was built. Swelling ratio and thrust reduction due to fluid elasticity were measured. The results indicate that both the swelling ratio and the ratio of the dynamic stresses in the relaxing jet to those due to inertia approach an asymptotic value at high rates of shear.
Dissert. Abstr.

N76-28499 Massachusetts Univ., Amherst.
THE DISPERSION OF DISCRETE PARTICLES IN A TURBULENT FLUID FIELD Ph.D. Thesis
Richard Vincent Calabrese 1975 276 p
Avail: Univ. Microfilms Order No. 76-14636

The effects of particle size inertia, free fall velocity, and relative density are studied for turbulent dispersion of particles whose size and characteristic time scale are greater than the corresponding fluid microscales but less than the corresponding fluid integral scales. Radial mean square displacement was measured as a function of travel time from a point source for several buoyant, neutrally dense, and heavy particles in the core of a fully developed turbulent pipe flow of water. Each value of particle mean square displacement was determined from observations of radial displacement as measured using a photographic technique. The dispersion data were fit to six different dispersion models derived from the theory of G. I. Taylor (1921) using different functional forms for the Lagrangian autocorrelation coefficient. It was found that all six dispersion models were capable of fitting the radial dispersion data equally well but predictions of turbulence parameters for both particles and tracer are superior when estimated from a model containing an exponential cosine, m = 1 form of the autocorrelation function. Dissert. Abstr.

N76-28500 Massachusetts Univ., Amherst.
HEAT TRANSFER IN FLUIDIZED BEDS OF LOW DENSITY, LARGE-SIZED PARTICLES Ph.D. Thesis
Vijay K. Arora 1976 186 p
Avail: Univ. Microfilms Order No. 76-14630

Surface-to-bed heat transfer mechanisms in a fluidized bed of low density (bulk density 1 - 12 lb/tu. ft.) large-sized (particle dia. 1/4 - 1 1/4 in.) particles were investigated. Heat transfer coefficients were experimentally measured for different sets of particles and fluidization conditions. Results indicate that the heat transfer mechanism in such fluidized beds is different than that now generally excepted for conventional fluidized beds of fine particles. Heat transfer rates in the fluidized bed under investigation were primarily governed by the fluid-film thickness along a heat transfer surface submerged in the bed. Mathematical

models were developed to determine heat transfer coefficients based upon film conduction and particle heat absorption mechanisms. Empirical correlations were also developed for different types of particles from the experimental data. Applications of such fluidized beds in food processing involving heat transfer operations were investigated in sausage thawing experiments. Results indicate that a substantial savings in process time can be obtained while thawing sausages in fluidized beds as compared to the forced convection method. Dissert. Abstr.

N76-28501 Rochester Univ., N.Y.
GENERALIZED EQUATIONS OF STATE FOR FLUIDS Ph.D. Thesis
Tien-Tsung Chen 1976 112 p
Avail: Univ. Microfilms Order No. 76-14752

A volume explicit generalized equation of state has been formulated for compressed and saturated liquids. The range of application is between 0.50 less than or equal to T sub r less than or equal to 0.99, and 0 less than or equal to P sub r less than or equal to 10.0. The equation can also be used to calculate enthalpy, fugacity and other thermodynamic properties. It compares favorably with other tabulated correlations and literature data. A volume explicit generalized equation of state has also been formulated for superheated and saturated vapor.
Dissert. Abstr.

N76-28502 Minnesota Univ., Minneapolis.
THERMOMECHANICAL MODELING FOR GASEOUS DIFFUSION IN ELASTIC STRESS FIELDS Ph.D. Thesis
Elias Charalambos Aifantis 1975 197 p
Avail: Univ. Microfilms Order No. 76-14862

A mechanical theory is formulated for the diffusion of a gas, behaving as an elastic fluid, through an isotropic elastic solid. It is assumed that each point of the mixture is occupied simultaneously by both constituents in given proportions. The mechanical properties of each component are specified by means of constitutive equations for the stresses. Diffusion effects are accounted for by means of a body force acting on each constituent which depends upon the composition, the elasticity of the solid, and the relative motion of the substances in the mixture. Coupled diffusion equations for both constituents are derived. Uncoupling of the equations is attempted within a linearized theory by adopting particular motions for the mixture. The result is compared with the classical diffusion equations derived by intuitive modifications to the empirical Fick's law.
Dissert. Abstr.

N76-28503 Texas Univ., Austin.
FINITE ELEMENT SOLUTIONS OF NONLINEAR COUPLED FLOW-STRESS PROBLEMS BASED ON MIXTURE THEORY Ph.D. Thesis
Mohamad Nazmi Sharabi 1975 108 p
Avail: NTIS Avail: Univ. Microfilms Order No. 76-14517

Equations governing the three dimensional transient response of fully saturated porous media due to dissipation of pore fluid pressure are derived systematically on the basis of the theory of mixtures. Finite deformations, nonlinear soil skeleton properties and variable permeability have been taken into account. Numerical procedures employing the finite element method are developed by using a five point quadrilateral interpolation for displacements with constant shear strain and a four point interpolation for pore fluid pressure. Logarithmic interpolation in time is used. Linear analysis results are compared with some of the existing analytical solutions of Terzaghi's and Biot's theories for the problems of consolidation of a bounded column of clay and a half space with strip load. The influences of nonlinear soil properties and variable permeability are examined and compared with the linear analysis. Dissert. Abstr.

N76-28504 Minnesota Univ., Minneapolis.
EFFECT OF MAIN STREAM VARIABLES ON HEATED AND UNHEATED JETS ISSUING FROM A ROW OF INCLINED ROUND HOLES Ph.D. Thesis
Kanichi Kadotani 1975 364 p
Avail: Univ. Microfilms Order No. 76-14914

Effects of the main stream variables on heated and unheated jets issuing from a row of inclined round holes were investigated from the viewpoint of film cooling. Experiments were carried out using an open circuit wind tunnel in which the main stream (subsonic room temperature air) passed at steady state conditions. Into the bottom wall of the wind tunnel a row of five 1.178 cm inner diameter tubes was cemented and mounted flush at three hole diameter spacing in the lateral direction with angles of 35 deg to the main stream direction. Film cooling effectiveness at centerline decreased and the effectiveness midway between holes increased with the increase of the boundary layer thickness. As a result, the laterally averaged effectiveness did not change with the boundary layer thickness. The equi-effectiveness contours stretched more downstream and spread less in the lateral direction for the smaller boundary layer thickness. Dissert. Abstr.

N76-28505 Case Western Reserve Univ., Cleveland, Ohio.
NON-EQUILIBRIUM TWO-PHASE FLOW THROUGH QUASI ONE-DIMENSIONAL CHANNELS Ph.D. Thesis
Upendra Singh Rohatgi 1975 136 p
Avail: Univ. Microfilms Order No. 76-16072

A non equilibrium flow analysis has been formulated for one component two phase flow through quasi one dimensional channels. The flow is considered homogeneous and essentially isothermal. Phase change is assumed to occur at heterogeneous nucleation sites, and the growth of the vapor bubbles is governed by heat conduction from the liquid to the vapor. The analysis is adjusted for friction loss at the wall and is applied to flow of liquid nitrogen through a venturi. The pressure distribution is also corrected at the throat junction for centrifugal effects that are not accounted for in the one-dimensional formulation. The solutions are compared with the NASA experimental results of Simoneau. Good agreement is obtained in the region of initial vaporization if the activation energy is taken as small but non zero. Dissert. Abstr.

N76-28506 Brown Univ., Providence, R.I.
FLOW THROUGH CHARGED MEMBRANES Ph.D. Thesis
Gurmukh Dass Mehta 1975 107 p
Avail: Univ. Microfilms Order No. 76-15665

The Stokes equation is solved for flow through a basic cell with a relatively simple geometry. In an attempt to improve the pipe model, the membrane is modeled by a cubical array of charged spheres. Three sets of partial differential equations describe this system: flux equations (which we have developed from the generalized dusty gas model), Navier-Stokes equations and the Poisson-Boltzmann equation. These equations are suitably averaged over a cell volume to yield a set of ordinary differential equations on the gross scale. It is shown that in hyperfiltration the cell model will reject salt more efficiently than the tube model and in the limit of Stokes flow this analysis reproduces the results obtained by the tube model. Results for the electrodialysis mode of membrane operation are presented both for linear and nonlinear cases. Dissert. Abstr.

N76-28507 Minnesota Univ., Minneapolis.
LOCAL AND AVERAGE TRANSFER COEFFICIENTS FOR MULTIPLE IMPINGING JETS Ph.D. Thesis
Richard Nelson Koopman 1975 125 p
Avail: Univ. Microfilms Order No. 76-14920

The analogy between heat and mass transfer, in conjunction with the naphtalene sublimation technique, was used to investigate the transfer capabilites of a row of circular jets impinging normal to a flat plate. In addition, single jet experiments were made for comparison under the same experimental conditions and jet-orifice geometry. The results are presented in dimensionless form in terms of the Sherwood number to facilitate their conversion to Nusselt numbers. The parameters that were varied included the jet Reynolds number, the jet-orifice spacing, and the jet orifice-to-impingement plate separation. A comparision between the single jet and multiple jet results demonstrated that the presence of additional jets produced effects which, in general, caused lower stagnation region transfer coefficients than for the single jet. It was concluded that mulitple jet impingement is attractive for use in equipment to produce more uniform surface conditions and with better control through parameter adjustment. Dissert. Abstr.

N76-28508 Texas Univ., Austin.
A BASIS FOR NUMERICAL MODELING OF FLUID AMPLIFIERS Ph.D. Thesis

James Arthur Nicholson 1975 157 p
Avail: Univ. Microfilms Order No. 76-14501

Laminar fluid flow in a simplified fluidic amplifier is analyzed using finite difference numerical techniques. Numerical solutions to the two dimensional incompressible Navier-Stokes equations are obtained in terms of stream function and vorticity. These solutions are presented as contour plots of lines of constant stream function. The effect of various flow parameters, such as Reynolds number, outlet port loading, and deflection of the power jet are examined. Finite difference solutions are also obtained for the pressure distribution. The problems associated with obtaining accurate numerical pressure solutions are discussed in detail. In particular, the problems associated with an inconsistent formulation of this Neumann problem are described. A large-scale laminar flow amplifier was designed and constructed so that the geometry matched that of the numerical simulation. Dye was injected into water flowing in the amplifier, and streamline photographs were obtained. Good agreement existed between the photographs and the numerically predicted streamlines. Extensions of the model aimed at producing a working tool for use in design of fluidic amplifiers are suggested. Dissert. Abstr.

N76-28509 Illinois Univ., Urbana.
FLOW OVER WAVY SURFACES Ph.D. Thesis
Daniel Paul Zilker, Jr. 1976 374 p
Avail: Univ. Microfilms Order No. 76-16217

Interactions between turbulent flow fields and wavy surfaces produce significant changes in the transport of heat, mass, and momentum by the flow field. The objective of this thesis was to study the influence of wave amplitude on the fundamental characteristics of the flow field over solid wavy surfaces. The determination of a range of amplitudes over which linear theory is applicable and the manner in which nonlinearities manifest themselves on and above the solid boundaries was a goal of this study. The other goal was to develop data to enable realistic modeling of wave induced fluctuating velocity components and Reynolds stresses. Measurement of velocity, turbulence quantities, surface shear stress, and surface pressure were obtained in a two inch high by twenty-four inch wide rectangular channel using water or an electrochemical solution as the transducing medium. Dissert. Abstr.

N76-28510 Societe Generale de Constructions Electriques et Mecaniques Alsthom, Grenoble (France).
TURBULENCE SIMULATION FOR CALCULATING MIXED CONVECTION FLOWS Final Report [LA SIMULATION DE LA TURBULENCE POUR LE CALCUL DES ECOULEMENTS DE CONVECTION MIXTE]
J. P. Bernard, J. F. Denoyelle, J. P. Huffenus, and J. L. Peube Jun. 1974 162 p refs In FRENCH
(Contract DGRST-72-7-0653)
Avail: Issuing Activity

A new scheme for turbulence simulation for mixed convection flows is proposed noting the inadequacy of the usual coupled differential equations to take into account the transitions from laminate to turbulent flow and the setup of equilibrium regimes. In the new scheme only the energy equation is kept and the turbulence scale is determined from the convection and the qualification of the environment of the point being considered in the calculation. An approximation of the modifications needed to take into account the gravity forces caused by density differences is proposed together with a few worked out examples. ESA

N76-28511*# National Academy of Sciences - National Research Council, Washington, D.C. Standing Committee on Mechanical Engineering.
CRITERIA FOR UNDERGROUND HEAT DISTRIBUTION SYSTEMS
1975 87 p refs
(Contract NASw-2461)
(NASA-CR-148514; TR-66) Avail: NTIS HC $5.00 CSCL 20M

Underground heat distribution system design and evaluation criteria are presented. Author

N76-28512*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATIVE BEHAVIOR OF A GAS LAYER SEEDED WITH SOOT
Robert Siegel Washington Jul. 1976 36 p refs
(NASA-TN-D-8278; E-8595) Avail: NTIS HC $4.00 CSCL 20D

Gaseous film or transpiration cooling may be used to reduce the heat flux reaching the wall of a container or other structures. Such a protective film, however, is usually not effective for reducing radiative heat transfer as most gases are transparent in the temperature range for which solid walls can exist. Therefore, heat transfer was examined for a gaseous layer seeded with radiation-absorbing carbon particles (soot) and flowing along a surface. The layer was subjected to an external high temperature source of blackbody radiation. The radiative behavior was found to depend on a parameter containing particle concentration, layer thickness and source temperature. Only a very small particle volume concentration, in the range of .0001, was required to obtain high absorption in a 1-cm-thick layer for typical conditions. The results provide the distance along the surface for which the heat transfer to the wall remains within an acceptable limit and the particles remain below a temperature at which they will melt or vaporize. The wall protection by the layer lasts only until the particles vaporize or the layer becomes so hot that it reradiates substantially to the wall. Depending on the layer mass velocity the protection may be effective for a distance along the wall of only a few layer thickness. Hence, to protect greater wall lengths, it will be necessary to introduce the suspension through multiple slots or holes along the wall. Author

N76-28513*# New York Univ., Westbury. Aerospace and Energetics Lab.
SKIN FRICTION REDUCTION BY SLOT INJECTION AT MACH 0.8 Final Report
Victor Zakkay and Chi R. Wang Washington NASA Jul. 1976 84 p refs
(Grant NsG-1049)
(NASA-CR-2694) Avail: NTIS HC $5.00 CSCL 20D

Surface skin friction, boundary layer profiles and turbulent intensity due to axially symmetric tangential slot injection into a transonic boundary layer were measured. Effects of slot height, multiple slot injection, and injection mass flow rate on the surface skin friction downstream of the the slot have been investigated. Surface skin friction was a function of the injection mass flow rate for $x/s > 40$. Large normal pressure gradient and relatively large turbulent intensity were found near the slot with small injection mass flow rate; the region the high turbulent intensity moved downstream with increasing injection mass flow rate. The results with two slot injections indicated that the distance between slots should be less than 30 slot heights in order to achieve some benefits from the first slot. Of significant importance in the present investigation is that the skin friction reduction obtained at transonic speed is of the same order as obtained in the hypersonic regime. Additional work is required in order to formulate a correlation between the turbulent intensity and the injection mass flow rate that may be used in future analysis. Author

N76-28514*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL AND COMPUTATIONAL INVESTIGATION OF THE FLOW FIELD ABOUT A TRANSONIC AIRFOIL IN SUPERCRITICAL FLOW WITH TURBULENT BOUNDARY-LAYER SEPARATION
Morris W. Rubesin, Arthur F. Okuno, Lionel L. Levy, Jr., John B. McDevitt, and H. Lee Seegmiller Jul. 1976 12 p refs
(NASA-TM-X-73157; A-6690) Avail: NTIS HC $3.50 CSCL 20D

A combined experimental and computational research program is described for testing and guiding turbulence modeling within regions of separation induced by shock waves incident in turbulent boundary layers. Specifically, studies are made of the separated flow the rear portion of an 18%-thick circular-arc airfoil at zero angle of attack in high Reynolds number supercritical flow. The measurements include distributions of surface static pressure and local skin friction. The instruments employed include highfrequency response pressure cells and a large array of surface hot-wire skin-friction gages. Computations at the experimental flow conditions are made using time-dependent solutions of ensemble-

averaged Navier-Stokes equations, plus additional equations for the turbulence modeling. Author

N76-28515*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLUTION TO THE DIFFERENTIAL EQUATION FOR COMBINED RADIATIVE AND CONVECTIVE COOLING FOR A HEATED SPHERE
Fred D. Wills and Lester Katz 1 Jun. 1976 11 p refs
(NASA-TM-X-73323) Avail: NTIS HC $3.50 CSCL 20M

A solution is presented for the differential equation relating the combined effects of radiative and forced convective cooling for a heated sphere. The equation has the form where T and t are the variables temperature and time, respectively, and K sub o, T sub o, and H are constants. The solution can be used as a guideline for the design and understanding of space processing phenomena. Author

N76-28516*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POWER CALCULATIONS FOR ISENTROPIC COMPRESSIONS OF CRYOGENIC NITROGEN
Jerry B. Adock and Marilyn E. Ogburn Jul. 1976 52 p refs
(Grant NsG-1010)
(NASA-TM-X-73903) Avail: NTIS HC $4.50 CSCL 20D

A theoretical analysis has been made of the power required for isentropic compressions of cryogenic nitrogen in order to determine the extent that the drive power for cryogenic tunnels might be affected by real gas effects. The analysis covers temperatures from 80 to 310K, pressures from 1.0 to 8.8 atm and fan pressure ratios from 1.025 to 1.200. The power required to compress cryogenic nitrogen was found to be lower than that required for an ideal diatomic gas by as much as 9.5 percent. Simple corrections to the ideal gas values were found to give accurate estimates of the real gas power values. Author

N76-28517# Lockheed Missiles and Space Co., Palo Alto, Calif.
FREE CONVECTION IN GAS AND LIQUID INTERLAYERS BETWEEN WALLS
V. K. Koshkin, ed. [1975] 9 p Transl. into ENGLISH of the book "Osnovy Teploperedachi v Aviatsionnoi i Raketno-Kosmicheskoi Tekhnike" Moscow, Mashinostroenie, 1975 p 96-106
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Illinois 60616

It is shown numerically that the greatest thermal stratification originates in horizontal cylinders upon supplying heat to the cylinder's side surface. Thermal stratification in rocket tanks and in reservoirs also turns out to be greatest when the heat flux is supplied at the side. The growth rate of the mass of stratified fluid layer is determined by the heated fluid flowing from the boundary layer into cylinder sections. G.G.

N76-28518# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
ON PARTICULAR SOLUTIONS OF THE OSEEN FLOW EQUATIONS
Carl Kaplan Oct. 1975 26 p refs
(Contract F44620-74-C-0024; AF Proj. 9781)
(AD-A020750; AFOSR-75-1703TR) Avail: NTIS CSCL 20/4

Particular solutions of the equations for the vorticity for both two-dimensional and axi-symmetrical Oseen flow are derived. They are then utilized for the solutions of the differential equations for the stream functions for the flow past a parabolic cylinder in two-dimensional flow and for the flow past a paraboloid of revolution in axi-symmetrical flow. By contrast, the present author showed in earlier papers that these two viscous-flow boundary-value problems can be formulated exactly as pairs of integral equations for unknown distributions of potential sinks-sources and their counterparts in Oseen flow, Oseenlets. Thus, the present treatment of these two problems avoids the difficulties inherent in the solution of pairs of integral equations. Author (GRA)

N76-28519# Naval Ship Research and Development Center, Bethesda, Md.
A STUDY OF THE HYDROELASTIC INSTABILITIES OF SWEPT SUPERCAVITATING HYDROFOILS Research and Development Report
Yuan-Ning Liu and John R. Caspar Jan. 1976 74 p refs
(SR0230101)
(AD-A020840; DTNSRDC-4686) Avail: NTIS CSCL 20/4

A theoretical study has been made of the flutter and divergence instabilities of cantilevered flexible hydrofoils in a supercavitating flow condition. A two-dimensional, fluid-loading theory is used to define the unsteady hydrodynamic loads acting along the span of a cantilevered lifting surface with or without sweep. The lifting surface has degrees of freedom both in bending and in torsion, each being a function of spanwise position. A Raleigh-Ritz type of flutter analysis, using only the fundamental uncoupled bending and torsion modes, was used to perform the calculations. The effects of varying the elastic and inertial properties, as well as the effects of varying the flow separation point on the hydroelastic instability characteristics, are determined. It is shown that a nonzero sweepback angle is essential for the occurrence of flutter instability for cantilevered foils in the low mass ratio region. Otherwise, divergence becomes the lowest stability boundary. In the low mass ratio range, the theory predicts that the bending motion predominates the flutter mode and that the flutter speed rises as a function of the secant of the sweep angle. The divergence speed increases much more rapidly as a function of increasing sweep angle throughout the entire mass ratio region. It is further shown that only moderate sweepback is required to eliminate divergence instability completely. Viewed as a whole, this study shows that predictions of hydroelastic instabilities in the low mass ratio region are extremely sensitive to small structural parametric variations. GRA

N76-28520# NAVSEA Hydroballistics Advisory Committee, Silver Spring, Md.
WATER ENTRY AND THE CAVITY-RUNNING BEHAVIOR OF MISSILES Final Technical Report
Albert May 1975 458 p refs
(SR02301002)
(AD-A020429; SEAHAC/TR-75-2) Avail: NTIS CSCL 19/1

This report contains a comprehensive compilation of test data and analytical techniques for predicting the behavior of vehicles during water entry and during the cavity-running phase. It contains data to predict the water impact forces on nose shapes such as disks, cones, ogives, spheres, cusps, disk ogives, etc. during vertical and oblique water entry. Cavity development phenomena are discussed and approximate ways of predicting cavity size and shape are presented. Stability characteristics during the early running phase are also discussed. In general, the report is intended to provide the necessary data for the design of water-entry ordnance. GRA

N76-28521# Nielsen Engineering and Research, Inc., Mountain View, Calif.
RESEARCH ON UNSTEADY TRANSONIC FLOW THEORY Technical Report, Jan. - 31 Dec. 1975
Stephen S. Stahara and John R. Spreiter Jan. 1976 71 p refs
(Contract N00014-73-C-0379; NR Proj. 061-215)
(AD-A021093; NEAR-TR-107) Avail: NTIS CSCL 20/4

Contents: Unsteady Transonic Aerodynamics - An Aeronautics Challenge; Unsteady Local Linearization Solution for Pulsating Bodies at M sub infinity = 1; and Unsteady Local Linearization Solution for Pitching Bodies of Revolution at M sub infinity = 1: Stability Derivative Analysis. GRA

N76-28522# Iowa State Univ. of Science and Technology, Ames. Heat Transfer. Lab.
AUGMENTATION OF HORIZONTAL IN-TUBE CONDENSATION OF STEAM
J. H. Royal and A. E. Bergles Sep. 1975 278 p refs
(PB-251067/5; ISU-ERI-AMES-76167; HTL-9) Avail: NTIS HC $9.25 CSCL 13A

The complete condensation of low pressure steam inside smooth and augmented horizontal tubes has been experimentally investigated. Smooth tubes were tested to establish reference conditions and to check existing in-tube condensation heat transfer predictive methods. Inclined tubes, twisted tape inserts, and internally finned tubes were tested as passive techniques to augment condensation. Tube inclination produced only modest improvements in heat transfer. Four internally finned tubes

produced increases in heat transfer coefficients as much as 150 percent above smooth tube values. GRA

N76-28523# Air Force Academy, Colo.
MEASUREMENTS OF BOUNDARY LAYER TRANSITION ON A SHOCK TUBE WALL FOR WALL COOLING RATIOS BETWEEN 0.39 AND 0.255 Final Report
Robert A. Golobic Dec. 1975 32 p refs
(AF Proj. 7905)
(AD-A021406; SRL-TR-75-0022) Avail: NTIS CSCL 20/4

Measurements of boundary layer transition on a shock tube wall have been made in the Frank J. Seiler Research Laboratory's 17 inch diameter shock tube for wall cooling ratios between 0.39 and 0.255. The data indicate that a reversal region does not exist in this wall cooling range. The majority of the measurements was made for a unit Reynolds number of 50 thousand per ft. Test times were measured, but no acoustic measurements were made. Hot-wire or cold-wire measurements are suggested for future experiments. GRA

N76-28524# Michigan Univ., Ann Arbor.
THE USE OF SPLINES FOR THE SOLUTION OF THE BOUNDARY-LAYER EQUATIONS Final Report, Mar. 1974 - Jun. 1975
Chen Chi Hsu Feb. 1976 49 p refs
(Contract F33615-74-C-1116; AF Proj. 7071)
(AD-A022345; AFFDL-TR-75-158) Avail: NTIS CSCL 20/4

A Galerkin method for the solution of steady two-dimensional incompressible laminar thermal boundary layer flow problems has been developed and tested. In this method the properly transformed boundary layer region is first divided into a very limited number of strips parallel to the boundary. Then, at a given streamwise station, classical cubic splines are employed to approximate the solution functions in each strip. The governing partial differential equations are finally reduced to a system of first order nonlinear ordinary differential equations by Galerkin's procedure, and the resulting initial value problem can be integrated numerically by a conventional method. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-28525 Illinois Univ., Urbana.
THE ATOM PROBE FIELD ION MICROSCOPE: FUNDAMENTAL PRINCIPLES OF OPERATION Ph.D. Thesis
Robert Sloane Chambers 1976 204 p
Avail: Univ. Microfilms Order No. 76-16104

The ability of the field ion microscope to characterize the chemical composition of a surface with atomic resolution has been investigated. The experimental techniques necessary for quantitative surface studies are presented. Introduced are the following capabilities: hole field emission measurements of the work function allowing an independent means for chemical characterization of the surface, automatic temperature measurement and control of the sample down to about 20 K, and optical alignment of the sample with the mass spectrometer, eliminating all aiming difficulties in time-of-flight measurements. Then, the physical principles essential to the operation of the probe, field ionization and time-of-flight mass spectrometry, are discussed in detail. Dissert. Abstr.

N76-28526 California Univ., Berkeley.
SUPERCONDUCTING JUNCTION BOLOMETERS Ph.D. Thesis
Gary Irl Hoffer 1975 103 p
Avail: Univ. Microfilms Order No. 76-15221

A composite bolometer was developed in which the temperature sensing element was a superconducting junction, the radiation absorber was a thin film of bismuth, and the support substrate was a piece of sapphire. Two types of junction were used: the superconductor-normal metal-superconductor (SNS) junction and the superconductor-insulator-normal metal (SIN) junction. The performance of these bolometers was measured and compared with that calculated from fundamental noise limits. Near ideal performance was achieved with SNS bolometers. The absorption of infrared radiation by bismuth films of various thicknesses on sapphire substrates was measured over the frequency range 3 to 300 cm/1 using a Fourier transform Michelson interferometer. The results were found to be in good agreement with theoretical calculations. Dissert. Abstr.

N76-28527 Georgia Inst. of Tech., Atlanta.
DETERMINATION OF GRATING SHAPE AND PHYSICAL MECHANISMS IN LITHIUM NIOBATE HOLOGRAPHIC RECORDING Ph.D. Thesis
Shing-Fong Su 1976 147 p
Avail: Univ. Microfilms Order No. 76-16285

The grating shape and physical mechanisms in lithium niobate holographic recording were studied. A method of calculating arbitrary-order diffraction efficiencies of thick transmission gratings with arbitrary periodic grating shapes was first developed. The relationship between the grating shape and the physical mechanisms (diffusion and drift of charge carriers) that occur during hologram recording were then investigated. Spacecharge field patterns are obtained by numerically solving difference-differential equations. A procedure for determining the refractive index profiles (grating shapes) of optically-induced thick dielectric gratings in ferroelectric crystals was also developed. In the final part of this program the preceding procedure was applied to a lithium niobate crystal. Holograms were recorded in different parts of the crystal. The diffraction efficiencies of these gratings were measured. The grating profiles of these gratings, as well as the percentage amounts of diffusion and drift in the process of hologram recording, were determined. Dissert. Abstr.

N76-28528 Laboratoire Central de Recherches Thomson-CSF, Orsay (France). Lab. Visualisation.
PHYSICAL PROPERTIES OF LIQUID CRYSTALS FOR DISPLAY DEVICES Final Report [ETUDE DES PROPRIETES PHYSIQUES DES CRISTAUX LIQUIDES EN VUE DE LA VISUALISATION]
J. Gouze, M. Hareng, S. LeBerre, and J. J. Metzger Oct. 1974 104 p refs In FRENCH
(Contract DGRST-73-7-1464)
(LCR-74-203/R/G.5) Avail: Issuing Activity

Helical nematic crystals were studied for use in display devices based on a new liquid crystal commercially available. The properties such as elastic constant, dielectric constant, and relaxation frequency were examined in detail, and the structure deformation under electric fields calculated for the specific crystal using the Frank and Leslie formalism. A separation was found between structure deformation and electrooptic effect with the consequence that the optical threshold changes with the receiving angle. Amplitude and frequency of the applied voltage, temperature, film thickness and wavelength were analyzed and their effects are discussed together with the importance of boundary conditions. A study of hysteresis of the cholesteric to nematic phase under elastic field showed that the effect was purely dynamic with very high time constant thus not affecting the proposed applications. However the wide cycle fluctuations with temperature lead to yet unsolved problems. ESA

N76-28529 Commissariat a l'Energie Atomique, Grenoble (France). Lab. d'Electronique et de Technologie de l'Informatique.
ELECTROCHEMICAL STUDY OF SOME NEMATIC LIQUID CRYSTALS TO IMPROVE THE LIFETIME OF DISPLAY DEVICES Final Report [ETUDE ELECTROCHIMIQUE DE CERTAINS CRISTAUX LIQUIDES NEMATIQUES EN VUE DE L'AMELIORATION DE LA DUREE DE VIE DES SYSTEMES D'AFFICHAGE]
Jacques Lacour, J. Robert, and B. Gosse Mar. 1975 26 p In FRENCH
(Contract DGRST-73-7-1728)
Avail: Issuing Activity

The oxide reduction reactions characteristic of certain families

of liquid crystals such as tolanes, phenyl and biphenyl benzoates were studied to find out the time evolution of a liquid crystal subjected to an electric field. An original technology for display cells enabled separation of the spacing function (SiO wall) from the closure function (indium). The thickness of the cells is then perfectly controlled leading to the possibility of all multiplexing.
ESA

N76-28530*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TV FATIGUE CRACK MONITORING SYSTEM Patent Application
Reginald J. Exton, inventor (to NASA) Filed 20 Jul. 1976 8 p
(NASA-Case-LAR-11490-1; US-Patent-Appl-SN-707125) Avail: NTIS HC $3.50 CSCL 14B

An apparatus is disclosed for monitoring the development and growth of fatigue cracks in a test specimen subjected to a pulsating tensile load. A plurality of television cameras photograph a test specimen which is illuminated at the point of maximum tensile stress. The television cameras have a modified vidicon tube which has an increased persistence time thereby eliminating flicker in the displayed images.
NASA

N76-28531*# Franklin Inst. Research Labs., Philadelphia, Pa.
TECHNIQUES AND INSTRUMENTATION EFFORT FOR WHALE MIGRATION TRACKING Final Report
R. M. Goodman, K. S. Norris (Calif. Univ., Santa Cruz), L. Hobbs (Calif. Univ., Santa Cruz), R. J. Gibson, E. Dougherty, and J. Palladino May 1975 178 p
(Contract NAS2-8013)
(NASA-CR-137903; F-C3799) Avail: NTIS HC $7.50 CSCL 14B

The following aspects of a research program concerned with tracking gray whales were documented: (1) design, fabrication and testing of a girdle-type harness and associated gear (release mechanism, tracking transmitter, xenon flasher), (2) design, fabrication and testing of instrumentation packs (subminiature recorder, sensor, electronics), (3) field preparations for the January-February 1974 expedition off Mexico, (4) travel arrangements, (5) preliminary field report (capture and handling of juvenile whales, instrumentation and housing tests, harness abrasion and chafing, respiration measurements, sea tracking, distribution, number, and behavior of whales at Lopez Mateos), (6) review, data reduction, and analysis of results.
Y.J.A.

N76-28532*# National Bureau of Standards, Washington, D.C.
A DYNAMIC PRESSURE SOURCE FOR THE CALIBRATION OF PRESSURE TRANSDUCERS Final Report
Carol F. Vezzetti, John S. Hilten, J. Franklin Mayo-Wells, and Paul S. Lederer Jun. 1976 35 p refs
(NASA Order L-88319)
(NASA-CR-148492; NBS-TN-914) Avail: NTIS MF $2.25; SOD HC $0.85 CSCL 14B

A dynamic pressure source is described for producing sinusoidally varying pressures of up to 34 kPa zero to peak, over the frequency range of approximately 50 Hz to 2 kHz. The source is intended for the dynamic calibration of pressure transducers. The transducer to be calibrated is mounted near the base of the thick walled aluminum tube forming the vessel so that the pressure sensitive element is in contact with the liquid in the tube. A section of the tube is filled with small steel balls to damp the motion of the 10-St dimethyl siloxane working fluid in order to extend the useful frquency range to higher frequencies than would be provided by an undamped system. The dynamic response of six transducers provided by the sponsor was evaluated using the pressure sources; the results of these calibrations are given.
Author

N76-28533*# Scientific Translation Service, Santa Barbara, Calif.
MONOCHROMATOR WITH SIMPLE GRATING ROTATION AND HOLOGRAPHIC GRATING ON TOROIDAL MOUNT FOR VACUUM UV
D. Lepere Washington NASA Jul. 1976 15 p refs Transl. into ENGLISH from Nouv. Rev. Optique (France), v. 6, no. 3, 1975 p 173-178
(Contract NASw-2791)
(NASA-TT-F-16736) Avail: NTIS HC $3.50 CSCL 14E

Currently available monochromators with concave gratings which are operated by simply rotating the grating, show a rapid decrease in the vacuum ultraviolet (at wavelengths longer than 800 A) because of relatively small angles of incidence at which these devices are operated. At high incidence angles low efficiency caused by astigmatism, accompanied by an equivalent reduction in energy throughput occurs. Efforts to correct this astigmatism in part by using a holographic grating are described. However, for short wavelengths at grazing incidence, a spherical concave holographic grating cannot have much effect on the astigmatism. This has led to the use of toroidal blanks, which minimize astigmatism over the entire spectral range. The design and testing of monochromator which utilizes a toroidal blank is described.
Author

N76-28534*# National Bureau of Standards, Washington, D.C. Inst. of Applied Technology.
STUDIES OF NOBLE-METAL THERMOCOUPLE STABILITY AT HIGH TEMPERATURES
P. Freeze and D. B. Thomas Jul. 1976 56 p refs
(NASA Order C-67546-B)
(NASA-CR-135055; NBSIR-76-1026) Avail: NTIS HC $4.50 CSCL 14B

Two investigatory studies on performance characteristics of noble-metal thermocouples are described. (1) thermoelectric stability as affected by preferential oxidation of iridium in the system iridium-40% rhodium versus iridium, and (2) the effects of temperature gradients on the emf stability of the systems platinum-13% rhodium versus platinum and iridium-40% rhodium versus iridium, operating in air. The stability investigation was carried out at three temperatures - 1700, 1850, and 2000 C - by comparing the output of the test thermocouple in air with the output of an identically constructed reference thermocouple in nitrogen. The results show that no calibration shift was observed producing a change in output greater than that corresponding to a 2.0% change in the indicated temperature for all samples tested. The investigation of gradient effects was carried out by subjecting test thermocouples to both severe and mild gradients for periods up to 200 hours. For the platinum system, the operating temperature was 1500 C with gradients of 1475 and 700 C/cm; for the iridium system, 2000 C with gradients of 700, 1500, and 1975 C/cm. Exposure to temperature gradients was found to introduce significant changes in calibration for both systems. In both investigations, the thermoelements were examined by means of electron-probe analysis and by metallographic methods to detect chemical and structural changes. Data and micrographs are presented.
Author

N76-28535*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLOW SEPARATION DETECTOR Patent Application
George G. Mateer and Aviel Brosh, inventors (to NASA) (NAS-NRC) Filed 6 Aug. 1976 19 p
(NASA-Case-ARC-11046-1; US-Patent-Appl-SN-712419) Avail: NTIS HC $3.50 CSCL 14B

A thermally insulating element is reported for sensing the fluid separation along a surface of an airfoil. The device has a continuous surface that blends into and forms a part of the fluid flow surface. A heating conductor is mounted at the element surface and sensing conductors are mounted on opposite sites of the heating conductor. When the fluid flow separates from the surface at the area of the heating and sensing conductors, a sudden decrease in temperature of the downstream sensor conductor and concomitant increase in temperature of the upstream sensor conductor is an indication of separation.
NASA

N76-28536# Bureau of Mines, Spokane, Wash. Mining Research Center.
DATA-ACQUISITION SYSTEMS FOR RADON MONITORING Report of Investigations, 1976
J. C. Franklin, R. J. Zawadski, T. O. Meyer, and A. L. Hill Jan. 1976 23 p refs
(PB-250739/0; BM-RI-8100) Avail: NTIS HC $3.50 CSCL 18D

A data acquisition system with five continuous flow monitors was designed for monitoring radon in the field and laboratory. The system can be set to monitor each detector up to 16.5 minutes and has a lower limit of 50 Ci/l and no upper

limit. All five detectors are accurate to plus or minus 15 percent of the total alpha count. The continuous flow monitor was calibrated in the laboratory at four different radon concentrations, and a least square fit was determined so that the total alpha count could be converted into p Ci/l of air. It was then checked against the two filter method at three concentrations with good agreement. GRA

N76-28537# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
THE CONSTRUCTION, OPERATION AND PERFORMANCE OF A REACTIVE GAS GENERATOR: WITH SPECIFIC APPLICATION TO HCHO, CH3CHO, CH2CHCHO, SO2, HCN AND HCl PRODUCTION Final Report
James A. Walker and W. Tsang Jan. 1976 55 p refs
(PB-251219/2; NBSIR-76-1000) Avail: NTIS HC $4.50 CSCL 14B

An instrument capable of generating a variety of reactive gases in trace levels has been constructed and tested. Operational details, with specific application to HCHO, CH3CHO, CH2CHCHO, SO2, HCN and HCl production, are discussed. GRA

N76-28538# Battelle Memorial Inst., Columbus, Ohio.
THE DEVELOPMENT OF A LOW Z STRAIN TRANSDUCER Final Report, Apr. 1974 - Mar. 1975
M. M. Lemcoe 26 Sep. 1975 100 p
(Contract DNA001-74-C-0252)
(AD-A021411; DNA-3647F) Avail: NTIS CSCL 14/2

Prototype, low Z strain transducers of three different designs were developed for measurement of strains to 4,000 microstrain laboratory impact testing of rings, frustra and other structural shapes. These transducers use beryllium foil electric resistance strain gages as the sensing elements which are wired in a half- or full-bridge arrangement to eliminate bending in the transducer and provide temperature compensation. The beryllium gages can withstand a maximum of 1,200 microstrain, due to the limited ductility of the beryllium foil. The transducers were designed to attenuate the strain and permit measurements to 4,000 microstrain, without subjecting the sensors to more than 1,200 microstrain. Attachment to the test article was by means of resistance spot-welding or electron-beam welding. GRA

N76-28747 World Meteorological Organization, Geneva (Switzerland).
A CONTINUOUS REMOTE DISPLAY SYSTEM FOR AIRFIELD USE
D. J. Painting *In its* Automated Meteorol. Systems 1975 p 22-29 refs (For availability see N76-28743 19-47)
Copyright.

N76-28751 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL MAGNETIC EVENT RECORDER
John M. Cook *In its* Automated Meteorol. Systems 1975 p 52-57 ref (For availability see N76-28743 19-47)
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N76-28758 World Meteorological Organization, Geneva (Switzerland).
THE CLIMATOLOGICAL AUTOMATED RECORDING STATION (CARS)
D. J. McKay *In its* Automated Meteorol. Systems 1975 p 104-113 (For availability see N76-28743 19-47)
Copyright.

N76-28764 World Meteorological Organization, Geneva (Switzerland).
INSTRUMENTAL EVALUATION OF CLOUDINESS
L. Tasso and G. Benedicti *In its* Automated Meteorol. Systems 1975 p 158-168 refs (For availability see N76-28743 19-47)
Copyright.

N76-28766 World Meteorological Organization, Geneva (Switzerland).
MICROPOWER SUNSHINE SENSOR FOR AWS
John M. Cook *In its* Automated Meteorol. Systems 1975 p 179-183 refs (For availability see N76-28743 19-47)
Copyright.

N76-28770 World Meteorological Organization, Geneva (Switzerland).
OPERATIONAL EXPERIENCE WITH THE HUMICAP RELATIVE HUMIDITY SENSOR
O. Waehrn and P. Kostamo *In its* Automated Meteorol. Systems 1975 P 207-216 ref (For availability see N76-28743 19-47)
Copyright. Avail: NTIS

N76-28771 World Meteorological Organization, Geneva (Switzerland).
A WIND AVERAGING SYSTEM FOR AUTOMATIC WEATHER STATIONS
D. J. Painting *In its* Automated Meteorol. Systems 1975 p 217-223 refs (For availability see N76-28743 19-47)
Copyright.

N76-28782 World Meteorological Organization, Geneva (Switzerland).
FIELD TESTING FOR SELECTION AND DEVELOPMENT OF HIGH RELIABILITY SENSORS
A. D. Stewart, D. J. McKay, and T. Hacking *In its* Automated Meteorol. Systems 1975 p 302-309 refs (For availability see N76-28743 19-47)
Copyright.

N76-29091* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
TESTING OF A PHOTOELECTRIC PHOTOMETER. 1: DETERMINATION OF OPERATIONAL PARAMETERS
Dennis W. Dawson and Edward F. Tedesco *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 148=153 refs (For availability see N76-29085 19-89)
CSCL 14B

N76-29092* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
TESTING OF A PHOTOELECTRIC PHOTOMETER. 2: OBSERVATIONAL TESTING
Dennis W. Dawson and Edward F. Tedesco *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 154-158 ref (For availability see N76-29085 19-89)
CSCL 14B

N76-29093* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
PHOTOMETRIC CALIBRATION OF PLANETARY PHOTOGRAPHS
Reta F. Beebe *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 159-163 ref (For availability see N76-29085 19-89)
CSCL 14E

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-28539 Illinois Univ., Urbana.
A DIRECT NUCLEAR PUMPED NEON-NITROGEN LASER Ph.D. Thesis
Russell John DeYoung 1976 127 p
Avail: Univ. Microfilms Order No. 76-16119

A new neutron driven laser is described that utilizes a boron-10 coating, Ne-N2 gas, and provides simultaneous output at 8629 and 9393 in nitrogen. This laser has several distinctive features; namely, the neutron flux, i.e., power input at threshold requirement is the lowest reported to date for nuclear pumping and the wavelengths fall into an attractive region in the near infrared. The neutron driven Ne-N2 laser was found to have an efficiency of 1.34 x 0.001 percent (peak total laser power out divided by peak power deposited in gas at 150 Torr Ne-N2). Dissert. Abstr.

N76-28540 California Univ., Berkeley.
VIBRATIONAL RELAXATION STUDIES IN CO2, N2O, AND H2O USING A TUNABLE INFRARED LASER Ph.D. Thesis

Jack Finzi 1975 204 p
Avail: Univ. Microfilms Order No. 76-15175

Laser-excited vibrational fluorescence experiments on the H2O asymmetric stretch, and on the CO2 and N2O combination levels are carried out with a tunable infrared laser. Rate constants near gas kinetic are obtained for CO2 and N2O and assigned to the near resonant V approaches V transfer of an asymmetric stretching quantum. Stimulated emission from the CO2 combination level at 4.3 micron is observed during laser excitation at 2.7 micron. Energy transfer experiments are conducted on water vapor and isotopically labeled H2O18. Water vibrationally relaxes with anomalously large rates. Energy transfer from the bending vibration to rotation and translation requires about 3.3 collisions. Energy is transferred from the bending overtone to the bending fundamental in only 2.3 collisions. Energy is transferred from the asymmetric stretch to the bend in 8 collisions. Argon is 200 times less effective than water, itself, as a collision partner. Measurements are made by direct excitation of single rotational levels of the asymmetric stretching vibration with an optical parametric oscillator. Infrared fluorescence is detected from the stretching and bending regions. Dissert. Abstr.

N76-28541 California Univ., Berkeley.
DYE LASER MECHANISMS Ph.D. Thesis
Omar Teschke 1975 169 p
Avail: Univ. Microfilms Order No. 76-15388

Continuous wave and long pulse dye laser operations are studied. Initially a theoretical treatment including absorption of the laser light by the ground state, singlet excited state and triplet state and the absorption of the pump light by the ground state and first singlet excited state is presented. Expressions for gain, output power and transmission are derived. Transmission measurements were performed with two purposes: first, as another way of determining the singlet excited state absorption cross section in a simpler manner, and second, to calculate the laser output power. The theoretical results show that the transmission is constant with laser action, and the experimental results confirm the theoretical transmission curves. Finally, thermal effects, the Gaussian beam profile and the overlapping of the pump and laser beams are considered. Dissert. Abstr.

N76-28542# Materials Research Labs., Maribyrnong (Australia).
SIMILARITY THEORY AND THE LABORATORY SIMULATION OF THERMAL BLOOMING
C. H. H. Carmichael Jan. 1976 18 p refs
(Rept-660) Avail: NTIS HC $3.50

The feasibility of carrying out a laboraotry simulation of the propagation of high-power laser radiation through the atmosphere is investigated. A theoretical analysis is presented for three cases distinguished by their different energy-transfer mechanisms, and in each case an example is given to indicate the kind of laboratory apparatus which would be required for simulation. Author

N76-28543# Electrotechnical Lab., Tokyo (Japan).
LASER EXCITATION ESR STUDIES ON LASER DYES
Mikio Yamashita Jan. 1976 94 p refs
(Rept-758) Avail: NTIS HC $5.00

The magnetic properties, relaxation and quenching mechanisms, and photochemical reactions related to the first excited triplet state (T state) in rhodamine, fluroescin, and acridine laser dyes were studied under continuous wave laser excitations. It was found that the principal molecular axes of the spin interaction tensor coincide with the chromophoric structural axes. The polarization of the pi electron distribution in the T state, and the electric dipole transition moment to the S sub 1 state of each type of dye are discussed. The photodegradation mechanisms at 77K in an R6G laser dye in ethanol are investigated by the direct detection of a decrease in the concentration of dye molecules in the T state. Author

N76-28544*# United Technologies Research Center, East Hartford, Conn.
EXPOSURE DAMAGE MECHANISMS FOR KCl WINDOWS IN HIGH POWER LASER SYSTEMS Final Report, Nov. 1974 - Mar. 1976
P. R. Blaszuk, B. A. Woody, C. O. Hulse, J. W. Davis, and J. P. Waters Mar. 1976 144 p refs
(NASA-CR-134982; R76-912038-12) Avail: NTIS HC $6.00 CSCL 20E

An experimental study of the 10.6 micrometer and 0.6328 micrometer optical properties of single crystal and europium doped polycrystal is described. Significant variations in the optical properties are observed over periods of exposure up to 100 hours. Models are proposed to predict the 10.6 micrometer absorptivity for long exposure periods. Mechanical creep has been detected in both materials at high temperature. Author

N76-28545# Lockheed Missiles and Space Co., Palo Alto, Calif.
MECHANISM OF HIGH-TEMPERATURE FOCUS FORMATION DURING LASER RUPTURE OF TRANSPARENT POLYMERS
A. A. Orlov and P. I. Uliakov [1976] 10 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 1, 1976 p 127-134
Avail: NTIS HC $3.50, National Translations Center, John Crerar Library, Chicago, Illinois 60616

The rupture of transparent polymers during absorption of laser radiation of millisecond duration by inclusions present in a real material is examined. It is shown that the distribution of the absorbing particles according to size in a polymer is subject to a cubic law corresponding to the aerosol distribution in the atmosphere. The process of heating the inclusions by laser radiation and of the formation of a gas cavity around it because of pyrolysis of the surrounding material is investigated. A mechanism of light absorption based on the process of soot-formation from gas phase hydrocarbons in both the rupture focus and in the growing macrocrack is proposed. Use of the macrokinetic parameters of high-temperature polymer pyrolysis to describe laser rupture yields satisfactory agreement between experimental and computed results. Author

N76-28546# California Univ., Livermore. Lawrence Livermore Lab.
HIGH STABILITY SPACE FRAME FOR A LARGE FUSION LASER
C. A. Hurley and J. O. Myall 3 Nov. 1975 7 p Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract W-7405-eng-48)
(UCRL-77242; Conf-751125-9) Avail: NTIS HC $4.50

The Shiva laser system is a large neodymium glass laser target irradiation facility to perform laser fusion experiments. A frame is being constructed to support the large number of laser components that make up the Shiva system. Twenty laser chains composed of amplifiers, spatial filters, polarizers, rotators, and mirrors will be arranged in an optimum geometry so that each beam arrives at the target simultaneously and within alignment tolerances. Consideration has been given to the positional stability and support of the components, the geometrical array of stacked beams with respect to the oscillator and target, the flow of utilities (e.g., power cables and cooling gas pipes), good accessibility for operation and maintenance, and adaptability for change and growth. Author (ERA)

N76-28547# California Univ., Livermore. Lawrence Livermore Lab.
SELF-GENERATED MAGNETIC FIELDS IN LASER PLASMAS
J. J. Thomson, C. E. Max, and D. T. Attwood 12 Aug. 1975 7 p refs Presented at the 7th European Conf. on Controlled Fusion, Lausanne, Switzerland, 1-5 Nov. 1975
(UCRL-77127; Conf-751131-1) Avail: NTIS

Megagauss-level magnetic fields were predicted theoretically and observed experimentally. The field generation due to resonance absorption of laser light and thermoelectric currents is discussed. An experiment to measure these fields by Faraday rotation of light (2660 A) is described. Author (ERA)

N76-28548# California Univ., Livermore. Lawrence Livermore Lab.
LASER FUSION EXPERIMENTS AT THE LAWRENCE LIVERMORE LABORATORY
H. G. Ahlstrom 8 Oct. 1975 95 p Presented at the APS Meeting, St. Petersburg, Fla., 10-14 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77094-Rev-1; Conf-751130-3) Avail: NTIS HC $6.00

A few of the parameters of the laser systems which are being used for these experiments are mentioned. Some information about specialized diagnostics which were developed at the Livermore Laboratory for these experiments is described. The focusing arrangements for each of the systems are discussed. Experiments both on planar targets and on targets for laser fusion are described. Author (ERA)

N76-28549# Technion - Israel Inst. of Tech., Haifa.
MACROSCOPIC DESCRIPTION OF LASER-TYPE MATTER Annual Technical Report, Aug. 1974 - Aug. 1975
I. R. Senitzky Sep. 1975 33 p refs
(Grant DA-ERO-75-G-012; DA Proj. 1T1-61102-B-31E)
(AD-A018741) Avail: NTIS CSCL 20/5

A formalism is developed, by means of boson Second Quantization Theory, which is particularly suitable for the description of the cooperative behavior of n-level systems (or the macroscopic description of laser-type matter). It is shown that semiclassical radiation theory represents the fully classical limit of this formalism. The theory of 'quantum beats' in the spontaneous emission from three-level atoms is analyzed, and criteria for the presence of beats that differ from those found in the recent literature are obtained. Author (GRA)

N76-28550# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RESEARCH IN LASER PROCESSES Semiannual Report, 1 Aug. 1975 - 31 Jan. 1976
A. V. Phelps and A. C. Gallagher 28 Feb. 1976 17 p refs
(Contract N00014-76-C-0123; ARPA Order 2683; NR Proj. 012-512)
(AD-A021209) Avail: NTIS CSCL 20/5

In order to provide data necessary for predicting the operating characteristics of proposed alkali atom-rare gas excimer lasers, measurements have been made of the fluorescence spectral intensity from the NaXe2 molecule. At Xe pressures of 20 atm, the NaXe2 fluorescence exceeds the NaXe fluorescence for wavelengths greater than 720 nm. New techniques have been developed for the calculation of the growth of instabilities in laser type discharges, and for the analyses of measurement of rate coefficients for the electron excitation of molecules. The collisional quenching of Na atoms in the 3 doublet P states has been observed and appears to be the result of excitation transfer to Na2 molecules. GRA

N76-28551# Massachusetts Inst. of Tech., Cambridge.
PROGRAM IN SUPPORT OF THE JUMPer PROGRAM FOR LASER ISOTOPE SEPARATION Semiannual Report, 1 Jul. - 31 Dec. 1975
A. L. McWhorter 31 Dec. 1975 88 p refs
(Contract F19628-76-C-0002; AF Proj. 920D)
(AD-A021403; ESD-TR-75-337) Avail: NTIS CSCL 20/6

Contents: Growth and characterization of nonlinear optical crystals--(CdGeAs2, AgGaSe2); application of infrared nonlinear materials--(Efficient, high average power SHG in CdGeAs2, average second harmonic power limitations in CdGeAs2, difference frequency mixing in CdGeAs2 at liquid nitrogen temperature); optically pumped transfer lasers--(CO transfer lasers, 16 micrometer CO2 laser, optically pumped 14 micrometer CO2 laser); CO2 laser development and evaluation--(12.2 micrometer wavelength calibration, high repetition rate Q-switched CO2). GRA

N76-28283* GTE Sylvania, Inc., Mountain View, Calif.
A HIGH RESOLUTION, ADJUSTABLE, LOCKABLE LASER MIRROR MOUNT
Curt H. Chadwick *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 116-124 (For availability see N76-28272 19-18)
CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-28552# Polish Academy of Sciences, Warsaw.
A DISCRETE MECHANICAL MODEL OF A TRI-AXLE MOTOR VEHICLE [DYSKRETNY MODEL MECHANICZNY TROJOSIOWEGO POJAZDU SAMOCHODOWEGO]
Andrzej Nalecz 25 Nov. 1975 82 p refs In POLISH
Avail: NTIS HC $5.00

A mechanical model of a motor vehicle is constructed to analyze vibrations from the point of view of applicability. Problems of automobile stability and controllability are analyzed by means of theoretical calculations. Author

N76-28553*# SKF Industries, Inc., King of Prussia, Pa.
MICROFOG LUBRICATION FOR AIRCRAFT ENGINE BEARINGS Technical Report, Sep. 1972 - Jun. 1975
J. W. Rosenlieb Apr. 1976 135 p refs
(Contract NAS3-16826)
(NASA-CR-134977; SKF-AL75T032) Avail: NTIS HC $6.00 CSCL 13I

An analysis and system study was performed to provide design information regarding lubricant and coolant flow rates and flow paths for effective utilization of the lubricant and coolant in a once through bearing oil mist (microfog) and coolant air system. Both static and dynamic tests were performed. Static tests were executed to evaluate and calibrate the mist supply system. A total of thirteen dynamic step speed bearing tests were performed using four different lubricants and several different mist and air supply configurations. The most effective configuration consisted of supplying the mist and the major portion of the cooling air axially through the bearing. The results of these tests have shown the feasibility of using a once through oil mist and cooling air system to lubricate and cool a high speed, high temperature aircraft engine mainshaft bearing. Author

N76-28554*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WRIST JOINT ASSEMBLY Patent Application
J. Dwight Johnston and Leendert Kersten, inventors (to NASA) (Nebraska Univ., Lincoln) Filed 26 Jul. 1976 22 p
(NASA-Case-MFS-23311-1; US-Patent-Appl-SN-708800) Avail: NTIS HC $3.50 CSCL 13I

A wrist joint assembly is provided for use with a mechanical manipulator arm for finely positioning an end-effector carried by the wrist joint on the terminal end of the manipulator arm wherein the wrist joint assembly is pivotable about a first axis to produce a yaw motion, a second axis to produce a pitch motion, and a third axis to produce a roll motion. The three axes are mutually perpendicular and have a common point of origin. The wrist joint assembly includes a disk segment affixed to the terminal end of the manipulator arm and a first housing member rotatably carried on the disk segment about the first axis. A second housing member is rotatably carried on the first housing member and a third housing member is rotatably carried on the second housing member whereby the third housing member and the mechanical end-effector carried thereon are moved in the yaw, pitch, and roll motion. NASA

N76-28555*# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF EXPLOSIVE WELDING PROCEDURES TO FABRICATE CHANNELED NOZZLE STRUCTURES Final Report
H. E. Pattee and V. D. Linse 2 Mar. 1976 52 p
(Contract NAS1-13320)
(NASA-CR-144977) Avail: NTIS HC $4.50 CSCL 13H

Research was conducted to demonstrate the feasibility of fabricating a large contoured structure with complex internal channeling by explosive welding procedures. Structures or nozzles of this nature for wind tunnel applications were designed. Such nozzles vary widely in their complexity. However, in their simplest form, they consist of a grooved base section to which a cover sheet is attached to form a series of internal cooling passages. The cover sheet attachment can be accomplished in various ways: fusion welding, brazing, and diffusion welding. The cover sheet has also been electroformed in place. Of these fabrication methods, brazing has proved most successful in producing nozzles with complex contoured surfaces and a multiplicity of internal channels. Author

N76-28556# Royal Aircraft Establishment, Farnborough (England).
EFFECT OF THE SIZE OF AXIAL AND RADIAL COMPRES-

SORS ON THEIR EFFICIENCY
W. Bolte Jan. 1976 18 p refs Transl. into ENGLISH from Brennstoff-Waerme-Kraft (Dusseldorf), v. 26, no. 10, 1974 p 441-445
(RAE-Lib-Trans-1881; BR53108) Avail: NTIS HC $3.50 CSCL 21E

An investigation was made into the rise in the efficiency of axial compressors with size, where size was characterised by the inspired volume flow rate. The efficiencies of axial and radial compressors are compared with one another at the design point. The axial compressor then turns out to be only about one efficiency point better than the radial compressor. In addition, a procedure is derived for calculating the exit pressure and the isentropic efficiency. Author

N76-28557# Dow Chemical Co., Midland, Mich. Functional Products and Systems.
RESEARCH ON FOAM-IN-PLACE EQUIPMENT TO PRODUCE SHELL STRUCTURES Interim Report, 2 Jan. 1973 - 2 Jan. 1975
A. J. Palfey and B. A. Russell Dec. 1974 155 p refs
(Contract DAAK02-72-C-0194)
(AD-A019709; FPS-435-15) Avail: NTIS CSCL 13/13

This Phase 2 technical report includes a review of the fabrication, assembly, debugging, and initial trial of the mechanical equipment to generate 30 ft. to 100 ft. diameter foam-in-place urethane dome structures. A commercial hydraulic telescoping rotary boom was produced and delivered by Fulton Industries, Inc. MOOG, Inc. furnished the automatic control system packages. Dow fabricated and assembled the pumping module and forming head systems which were integrated with the Fulton equipment to complete the package unit. After assembly, the preliminary debugging, trial wall sections were made on a polystyrene foam starter ring. These wall sections were tested and appeared satisfactory structurally. GRA

N76-28558# Army Construction Engineering Research Lab., Champaign, Ill.
FRACTURE CHARACTERISTICS OF STRUCTURAL STEELS AND WELDMENTS Final Report
J. Aleszka and Y. G. Kim Nov. 1975 114 p refs
(DA Proj. 4A7-61102-AT-23)
(AD-A019930; CERL-TR-M-170) Avail: NTIS CSCL 13/5

This report presents the findings of a scanning electron microscope study of the tensile, fatigue, and impact fracture characteristics of a carbon steel; two high-strength, low-alloy steels; and a high-strength steel weldment. Tension and fatigue specimens were tested in as-received, hydrogen-embrittled, and temper-embrittled conditions, while impact specimens were tested in the as-received condition only. The failure mode of embrittled and unembrittled weldments containing induced weld defects was also studied. GRA

N76-28559# Army Construction Engineering Research Lab., Champaign, Ill.
EVALUATION OF LUNAR DRILLING TECHNOLOGY FOR TERRESTRIAL APPLICATIONS. DIAMOND DRILL BIT EVALUATION Final Report
R. E. Aufmuth Jul. 1975 55 p
(DA Proj. 4A1-62621-A-890)
(AD-A013387; CERL-TR-M-138) Avail: NTIS CSCL 13/9

The results of a study evaluating four diamond drill bits of the design developed for lunar exploration are presented. Two of the bits were constructed with the original diamond drill bits using gem quality, geometrically oriented diamonds. The other two bits were cast specifically for this study, using standard industrial diamonds, randomly oriented. Identical rock materials, representing the three major rock classifications, were drilled with each of the bits until the bits were worn out or destroyed.

N76-28560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILIZED THYRISTOR SOURCE OF ASYMMETRIC HETEROPOLAR CURRENT FOR THE ARGON-ARC WELDING OF ALUMINUM ALLOYS
L. N. Bykov, L. L. Pavlov, B. Ye. Tyufanov, A. A. Nosko, and N. M. Voropay 8 Dec. 1975 12 p Transl. into ENGLISH from Povysheniye Effektivnosti Ustroystv Preobrazovatel'noy Tekhniki, Chast i (USSR), 1972 p 331-338
(AD-A019139; FTD-ID(RS)T-2284-75) Avail: NTIS CSCL 13/8

A method of welding is developed using an asymmetric heteropolar current with which the amplitude of the current of direct polarity is several times greater than the amplitude of the current of reverse polarity. GRA

N76-28561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FROM ENEMY TO ALLY
K. Yakovleva 17 Dec. 1975 7 p Transl. into ENGLISH from Pravda Vostoka (USSR), no. 240, p 3
(AD-A019779; FTD-ID(RS)I-2462-75) Avail: NTIS CSCL 13/9

One of the important problems which scientists and entire scientific research groups have been solving for more than a decade is the problem of raising the longevity of machines and mechanisms. This paper reports on the Soviet research of this subject. GRA

N76-28274* Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
A MOBILE PLANETARY LANDER UTILIZING ELASTIC LOOP SUSPENSION
W. Trautwein *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 11-25 refs (For availability see N76-28272 19-18)
CSCL 13I

N76-28277* Dornier-System G.m.b.H., Friedrichshafen (West Germany).
DESIGN PRINCIPLES OF A ROTATING MEDIUM SPEED MECHANISM
R. G. Hostenkamp, E. Achtermann, and R. H. Bentall (ESTC) *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 52-61 refs (For availability see N76-28272 19-18)
CSCL 13I

N76-28281* Hughes Aircraft Co., Culver City, Calif.
ASSURANCE OF LUBRICANT SUPPLY IN WET-LUBRICATED SPACE BEARINGS
Frank A. Glassow *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 90-103 refs (For availability see N76-28272 19-18)
CSCL 13I

N76-28282* Planning Research Corp., Los Angeles, Calif.
DESIGN OF MECHANISMS TO LOCK/LATCH SYSTEMS UNDER ROTATIONAL OR TRANSLATIONAL MOTION
Rohinton P. Billimoria *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 104-115 refs (For availability see N76-28272 19-18)
CSCL 13I

N76-28290* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ARRAY DRIVE SYSTEM
Frank D. Berkopec, John C. Sturman, and R. W. Stanhouse (GE, Philadelphia) *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 185-197 refs (For availability see N76-28272 19-18)
CSCL 22B

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-28562 Illinois Univ., Urbana.
ESTIMATION OF THE FATIGUE CRACK INITIATION LIFE IN WELDS USING LOW CYCLE FATIGUE CONCEPTS Ph.D. Thesis
Rodrigo Jose Mattos 1976 206 p
Avail: Univ. Microfilms Order No. 76-16163

An analytical model for calculating the fatigue crack initiation life of welds was developed. Computation of the local stresses

and strains was performed using Neuber's equation, and the fatigue behavior of the material at the critical location was computer simulated using a rheological model. Verification of the model was accomplished by comparing fatigue crack initiation life predictions with data obtained by testing simulated weld specimens and by utilizing data from the literature for several notch geometries, materials, and fatigue loading conditions. Factors influencing the fatigue crack initiation life of welds were analyzed. The results of this analysis indicate that the fatigue crack initiation life of welds is influenced by the micro- and macrogeometry of the weld reinforcement, the residual stresses, and very markedly by the material properties. They also indicate that the fraction of the fatigue life spent in fatigue crack initiation is dependent on the material and on the fatigue regime under consideration. Dissert. Abstr.

N76-28563* National Aeronautics and Space Administration. Pasadena Office, Calif.

METHOD AND APPARATUS FOR NONDESTRUCTIVE TESTING OF PRESSURE VESSELS Patent

Richard K. Steele (Aerojet-General Corp., El Monte, Calif.), Allen T. Green (Aerojet-General Corp., El Monte, Calif.), and Charles S. Lockman, inventors (to NASA) (Aerojet-General Corp., El Monte, Calif.) Issued 8 Dec. 1970 9 p Filed 9 May 1967 Sponsored by NASA

(NASA-Case-NPO-12142-1; US-Patent-3,545,262; US-Patent-Appl-SN-637249; US-Patent-Class-73-88.5) Avail: US Patent Office CSCL 14D

An improved method and apparatus are reported for nondestructive testing of pressure vessels to detect and locate structural flaws. The method relies on upon the principle of stress wave propagation through the material of the structure at sound velocity. Several stress wave sensors are attached to the structure at spaced locations for the detection of flaw propagated stress waves traveling through the wall of the vessel. Location of the flaw in the wall of the pressure vessel is determined by a triangulation technique which relies upon the time differences as to the arrival of the stress wave at various sensor locations. Official Gazette of the U.S. Patent Office

N76-28564 Illinois Univ., Urbana.

DESIGN OF FAIL-SAFE ASYNCHRONOUS SEQUENTIAL MACHINES Ph.D. Thesis

Yu-Dar Fan 1976 83 p

Avail: Univ. Microfilms Order No. 76-16131

Two methods for the fail-safe design of asynchronous sequential machines are presented in this paper. In the first method, ordinary binary logic elements are used in the realization. Signals are duplicated to guarantee the safe value of the output in the 0-fail-safe or 1 fail-safe case, and a new state assignment method is used in the N-fail-safe case. In the second method, complete sets of fail-safe logic elements are designed first and then assembled into fail-safe realizations. For the N-fail-safe case, two approaches are discussed: one uses three valued logic, the other uses a binary encoding. Dissert. Abstr.

N76-28565*# Martin Marietta Corp., Orlando, Fla.

BIBLIOGRAPHY OF INFORMATION ON MECHANICS OF STRUCTURAL FAILURE (HYDROGEN EMBRITTLEMENT, PROTECTIVE COATINGS, COMPOSITE MATERIALS, NDE)

James L. Carpenter, Jr. Jun. 1976 169 p refs

(Contract NAS3-19530)

(NASA-CR-134964; OR-14177) Avail: NTIS HC $6.75 CSCL 14D

This bibliography is comprised of approximately 1,600 reference citations related to four problem areas in the mechanics of failure in aerospace structures. The bibliography represents a search of the literature published in the period 1962-1976, the effort being largely limited to documents published in the United States. Listings are subdivided into the four problem areas: Hydrogen Embrittlement; Protective Coatings; Composite Materials; and Nondestructive Evaluation. An author index is included. Author

N76-28566*# Martin Marietta Corp., Baltimore, Md.

LONG-LIFE MISSION RELIABILITY FOR OUTER PLANET ATMOSPHERIC ENTRY PROBES Final Report

M. T. McCall, L. Rouch, and J. N. Maycock May 1976 51 p refs

(Contract NAS2-8999)

(NASA-CR-137836) Avail: NTIS HC $4.50 CSCL 14D

The results of a literature analysis on the effects of prolonged exposure to deep space environment on the properties of outer planet atmospheric entry probe components are presented. Materials considered included elastomers and plastics, pyrotechnic devices, thermal control components, metal springs and electronic components. The rates of degradation of each component were determined and extrapolation techniques were used to predict the effects of exposure for up to eight years to deep space. Pyrotechnic devices were aged under accelerated conditions to an equivalent of eight years in space and functionally tested. Results of the literature analysis of the selected components and testing of the devices indicated that no severe degradation should be expected during an eight year space mission. Author

N76-28567# Army Materials and Mechanics Research Center, Watertown, Mass.

PRELIMINARY DEVELOPMENT OF ULTRASONIC C-SCAN TEST METHODS AND STANDARDS TO DETERMINE PROJECTILE-ROTATING BAND INTEGRITY Final Report

Robert H. Brockelman, Robert A. Muldoon, and Daniel J. Roderick Jan. 1976 18 p

(DA Proj. 1W6-64603-D-663)

(AD-A020970; AMMRC-TR-76-1) Avail: NTIS CSCL 19/1

In the attachment of a copper rotating band to a projectile body, craters, unbonds, and crack systems may develop. These defects may produce serious structural failures or aerodynamic instability. The ultrasonic C-scan evaluation of roating bands on 8-inch diameter projectiles was conducted using both longitudinal and shear angle techniques to assess the integrity of the weld overlay band and the shell body. The longitudinal wave method was used to inspect for unbond areas at the interface of the shell body and rotating band. From this work it was ascertained that ultrasonic C-scanning yields an accurate representation of unbond areas developed during the weld overlay method of attaching rotating bands. Cracks and craters at the outer diameter of the steel body were investigated by means of the shear angle beam method. It was found that at an optimum shear angle of 45 deg, longitudinal saw cuts of various depths and also actual weld craters in the steel shell are readily detected and recorded with C-scan techniques. Author (GRA)

N76-28568# Picatinny Arsenal, Dover, N.J.

LEAD INITIATION BY M55 DETONATOR ACROSS AIR GAP

W. G. Schmacker and W. E. Voreck Dec. 1975 91 p refs

(DA Proj. 1T5-67603-A-559)

(AD-A020535; PA-TR-4779) Avail: NTIS CSCL 19/1

Efficiency of detonation transfer, or acceptor initiation, was measured by the time required to transmit a detonation through the explosive acceptor charge. Measurement methods based on detonation electric signals and on pin switches were developed. These were used to explore some of the variables in detonation transfer from M55 detonators to acceptor charges across an air gap. GRA

N76-28569# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

SEMICONDUCTOR MEASUREMENT TECHNOLOGY: LASER SCANNING OF ACTIVE SEMICONDUCTOR DEVICES: VIDEOTAPE SCRIPT Final Report

David E. Sawyer and David W. Berning Feb. 1976 25 p refs (ARPA Order 2397)

(PB-250842/2; NBS-SP-400-27; LC-75-619427) Avail: NTIS HC $3.50 CSCL 14B

The report is the script of a videotape presentation which describes new and powerful applications for laser scanning in semiconductor device design and reliability work. The design of the scanner is described in detail and many of its applications are displayed and discussed. The optical scanner can, in a completely nondestructive way, reveal the inner workings of semiconductor devices. For example, it is shown that the scanner can (1) map dc and high-frequency gains in transistors, (2) reveal areas of the device operating in a nonlinear manner, (3) electronically map temperature in the transistor and (4) detect

the location of hot spots that can develop for certain operating conditions. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-28570 Rutgers Univ., University Park, N.J.
OVERALL AND LOCAL BEHAVIOR OF STIFFENED PLATES Ph.D. Thesis
Dipak Kumar Agarwala 1976 110 p
Avail: Univ. Microfilms Order No. 76-16382

The first part of this study is concerned with the determination of the overall and local behavior of an orthotropic bridge model stiffened by open type of stiffeners under simulated highway loading. The bending behavior of these stiffened plates is known as Huber's equation and is a fourth order differential equation relating the vertical displacement of the plate to the distributed load. The numerical technique used to solve the differential equation was the finite difference method modified to take into account the effect of finer mesh under the simulated wheel load. The second part of the thesis consists of determining experimentally the stresses in the closed ribs of a stiffened plate due to the action of simulated highway load. From this study it was concluded that the distortional strain is maximum at the rib and plate function. Dissert. Abstr.

N76-28571 Georgia Inst. of Tech., Atlanta.
DISCRETE FIELD STABILITY ANALYSIS OF RIBBED PLATES Ph.D. Thesis
Dieter Karl Bounin 1976 167 p
Avail: Univ. Microfilms Order No. 76-15514

Discrete field analyses are used to derive formulas from which the elastic buckling behavior of ribbed plates subjected to uniform longitudinal compression can be determined. The problem is treated by two methods, termed here a micro and macro analysis, respectively. The two methods lead to dissimilar types of equations that have identical numerical solutions. For both types of analyses the stability equations are in terms of the coefficients of the finite series solutions. The relatively simple stability equations are numerically solved for critical buckling loads. The form and complexity of these equations are independent of the number of ribs in the system. Results are graphically illustrated to show effects of various problem parameters on ribbed plate stability. Dissert. Abstr.

N76-28572 Cornell Univ., Ithaca, N.Y.
FINITE ELEMENT ELASTIC INSTABILITY ANALYSIS OF DOUBLE CURVATURE DEEP SHELLS Ph.D. Thesis
Vinod Laxmichand Kanodia 1976 201 p
Avail: Univ. Microfilms Order No. 76-15883

A doubly curved thin shell triangular finite element method for the linear static and instability analysis of a wide class of plate and shell structures is presented. These structures include shells which are shallow, deep, singly curved and doubly curved and also those which are made up of an assemblage of component shells with different geometries. The finite element was formulated based on a generalization of the variational principle of minimum potential energy. Complete cubic polynomials were chosen to represent three displacement components within each element. The Lagrange Multiplier technique was employed to enforce the constraint of normal slope continuity at interelement boundaries. The problem of the importance of sheli geometry and distributed load approximation was identified and studied. It was found that the better these are represented the more accurate become analysis results for a given level of grid refinement. The versatility and accuracy of the finite element formulation and an associated computer program was established based on solutions, a comparison of results of a number of test cases of practical shell structures, and published results of other numerical approaches. Dissert. Abstr.

N76-28573 Brown Univ., Providence, R.I.
PLASTIC FLOW AND FRACTURE BEHAVIOR OF DUCTILE MATERIALS INCORPORATING VOID NUCLEATION, GROWTH, AND INTERACTION Ph.D. Thesis
Arthur L. Gurson 1975 236 p
Avail: Univ. Microfilms Order No. 76-15642

Yield criteria and flow rules for dilatant (void containing, porous) materials, showing the role of hydrostatic stress in yield and void growth were studied. The form of the yield criterion under combined stress is a central element in the constitutive relation. The yield criteria are approximated through an upper bound approach. Simplified physical models for ductile porous materials are employed, with the matrix material idealized as rigid-plastic and obeying the von Mises yield criterion. Velocity fields are developed for the matrix which conform to the macroscopic flow behavior of the bulk material. Using a distribution of macroscopic flow fields and working through a dissipation integral, upper bounds to the macroscopic stress fields required for yield are calculated. Their locus in stress space forms the yield locus. It is shown that normality holds for this yield locus, so a flow rule also results. Approximate functional forms for the yield criteria are developed. Dissert. Abstr.

N76-28574 Brown Univ., Providence, R.I.
INTERACTION OF BRITTLE FRACTURE AND STRESS WAVES Ph.D. Thesis
Vikram Kumar Kinra 1975 172 p
Avail: Univ. Microfilms Order No. 76-15651

The first part of this work is concerned with the stress pulses which are emitted during fracture of rectangular glass rods in uniaxial tension. These pulses were recorded by using strain gages and both a longitudinal and a flexural pulse were observed. The former travelled with little dispersion while the latter changed its shape continuously as it propagated down the rod. The experimentally recorded pulse shapes were found to be in excellent agreement with the predicted ones. In addition, it is shown that the section geometry does not influence the bifurcation behavior to any appreciable extent. In the second part several aspects of interaction of brittle fracture and the fracture induced stress waves in glass beams subjected to pure bending were studied by using strain gage techniques and also by the use of a high-speed Kerr-cell Framing Camera.
Dissert. Abstr.

N76-28575 George Washington Univ., Washington, D.C.
INELASTIC RESPONSE OF BEAM-PLATE ASSEMBLAGES SUBJECTED TO STATIC AND DYNAMIC LOADS Ph.D. Thesis
Khalilollah Khozeimeh 1974 150 p
Avail: Univ. Microfilms Order No. 76-16262

An analytical study is made of the inelastic behavior of structural systems consisting of beam-plate assemblages and subjected to static and dynamic loads. Such structures are idealized as a collection of finite elements. The governing differential equations of motion for the system are derived through the application of Hamilton's Principle. In case of static loading, the above equations are specialized by neglecting temporal terms. In both cases, the governing equations are solved numerically. Numerical examples demonstrating the applicability of the proposed method are presented, and the results are compared, when applicable, with the work of other investigators, both of experimental and theoretical nature. Dissert. Abstr.

N76-28576 Illinois Univ., Urbana.
TECHNIQUES FOR EXTRACTING THE COMPLEX RESONANCES OF A SYSTEM DIRECTLY FROM ITS TRANSIENT RESPONSE Ph.D. Thesis
Michael Lee VanBlaricum 1976 152 p
Avail: Univ. Microfilms Order No. 76-16209

The singularity expansion method is used for writing the transient response of a structure as a sum of exponentially damped sinusoids. In order to apply this method, it is first necessary to obtain the singularities of the system being studied. The conventional approach for determining the singularities of a system is based on an iterative search procedure that seeks the zeros of the system determinant in the complex frequency plane. The alternative approach of extracting the system singularities directly from the transient response function is discussed. The method

developed is based on Prony's algorithm. Some basic problems which are associated with the use of Prony's algorithm are discussed and solutions are obtained. Dissert. Abstr.

N76-28577 Brown Univ., Providence, R.I.
PLANE CRACKS IN HIGHLY ANISOTROPIC BODIES Ph.D. Thesis
Victor Sanchez-Moya 1975 61 p
Avail: Univ. Microfilms Order No. 76-15706

Materials composed of strong fibers embedded in a weaker matrix can be treated theoretically by: (1) an idealized theory, in which the fibers are regarded as inextensible and the composite as incompressible in bulk; (2) an inextensible theory, in which the condition of bulk incompressibility is not used; and (3) elasticity theory, with the fiber extensibility small but not zero. The problem of plane deformation of a cylindrical body with a crack perpendicular to the fibers is examined with each of these three theories. In particular, the energy release rate for the opening mode of crack advance is calculated. It is found that the result given by the simplest idealized theory remains qualitatively valid in each of the other two theories, with small quantitative differences depending upon the small compressibility and extensibility allowed by the latter theories. Dissert. Abstr.

N76-28578 Brown Univ., Providence, R.I.
SOME PROBLEMS IN ELASTIC-PLASTIC FINITE ELEMENT ANALYSIS OF CRACKS Ph.D. Thesis
David Moore Parks 1975 125 p
Avail: Univ. Microfilms Order No. 76-15688

Often tangent-stiffness finite element solutions for elastic-plastic materials exhibit too stiff a response in the fully plastic range. A cause of this inaccuracy is that incremental deformation fields of typical finite elements are highly constrained in fully plastic range. This enforces unreasonable kinematic constraints on the deformation modes which assemblages of elements can exhibit. A criterion for testing meshes with topologically similar repeat units is given, and the analysis shows that only a few conventional elements are suitable for fully plastic computations. A new variational principal, which can be simply incorporated into an existing program, is presented, which allows for accurate computations. Numerical results are given for example problems, substantiating the analysis and the suitability of the new variational principal. Dissert. Abstr.

N76-28579 Brown Univ., Providence, R.I.
A FINITE ELEMENT ALGORITHM FOR THE DETERMINATION OF DYNAMIC STABILITY Ph.D. Thesis
Richard Harvey Messier 1975 94 p
Avail: Univ. Microfilms Order No. 76-15666

An algorithm for determining the dynamic stability limit of a structure under a specified time-dependent loading was developed. In order to arrive at an explicit, concise algorithm, it was necessary to formulate a dynamic instability criterion to predict the onset of buckling during the time history of response of a structure to a specified transient external load. A criterion satisfying this requirement was developed and shown to be closely related to the static buckling criterion universally used in finite element analysis. A method for approximating the geometrically nonlinear dynamic response of a structure was developed based on the modal superposition procedure and a technique herein known as the mean stiffness approach. These two developments were incorporated into a self-consistent extrapolation technique wherein the linearity of the modal superposition dynamic analysis method, combined with the mean stiffness approach, was used to predict the value of the external load at which the dynamic instability criterion is satisfied. Dissert. Abstr.

N76-28580 Brown Univ., Providence, R.I.
FINITE DEFLECTIONS OF AN IMPULSIVELY LOADED FULLY CLAMPED VISCOPLASTIC PLATE BY AN EXTENSION OF THE MODE APPROXIMATION TECHNIQUE Ph.D. Thesis
Choon Taik Chon 1975 65 p
Avail: Univ. Microfilms Order No. 76-15617

The extension of the mode approximation technique to the dynamic plastic response with finite deflections of a circular plate is considered. Treating the structure as a sandwich plate, the exact constitutive equations for the strain-rate sensitive material, which include full interactions between the four generalized stresses (two bending moments and two in-plane forces) are derived. The problem of a fully clamped circular plate subjected to uniform initial impulsive pressure is solved, using the above technique and constitutive equations. An iteration scheme is introduced which furnishes an instantaneous mode solution at each of a sequence of times, taking account of the current state of deformation. Finally, comparison is made with results of several experiments reported in the literature. Dissert. Abstr.

N76-28581# Polish Academy of Sciences, Warsaw.
REFLECTION AND DEFLECTION OF AN ACCELERATION WAVE IN A NONLINEAR ELASTIC MATERIAL [ODBICIE I ZALAMANIE FALI PRZYSPIESZENIA W NIELINIOWYN MATERIALE SPREZYSTYM]
Piotr Borejko 16 Sep. 1975 29 p refs In POLISH
Avail: NTIS HC $4.00

The problem of reflection and deflection of a wave of acceleration on the borderline of two nonlinear elastic materials is considered. It is proven that the acceleration wave can be transmitted through a characteristic surface. Based on the concept of retardation surface, the quantity of reflected and deflected waves is determined and the law of acceleration wave reflection and deflection is deduced. It is proven that amplitudes of reflected (deflected) waves are linearly independent. It is shown that the acceleration wave of the borderline of isotropic initially undeformed linear elastic materials is reflected and deflected identically as a flat infinitesimal wave on the borderline of two isotropic linear elastic materials. Author

N76-28582# Polish Academy of Sciences, Warsaw.
LIMITARY CARRYING CAPACITY OF METAL WHEEL PLATES [NOSNOSC GRANICZNA, METALOWYCH PLYT KOLOWYCH]
J. Sokol-Supel, A. Grabarski, and A. Sawczuk 22 Sep. 1975 83 p refs In POLISH
Avail: NTIS HC $5.00

Solutions are presented for limit carrying capacity problems of wheel and ring plates made of material subjected to Huber-Mises plasticity. The method of obtaining solutions is clarified, and the principles according to which a program for providing numerical solutions is constructed on a calculator are given. Fundamental elements of the program are cited. Author

N76-28583*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
METHODS FOR COMBINING PAYLOAD PARAMETER VARIATIONS WITH INPUT ENVIRONMENT Final Report
D. H. Merchant 30 Jun. 1976 124 p refs
(Contract NAS8-31240)
(NASA-CR-149939; D180-19275-1) Avail: NTIS HC $5.50 CSCL 13M

Methods are presented for calculating design limit loads compatible with probabilistic structural design criteria. The approach is based on the concept that the desired limit load, defined as the largest load occurring in a mission, is a random variable having a specific probability distribution which may be determined from extreme-value theory. The design limit load, defined as a particular of this random limit load, is the value conventionally used in structural design. Methods are presented for determining the limit load probability distributions from both time-domain and frequency-domain dynamic load simulations. Numerical demonstrations of the method are also presented.
Author

N76-28584*# Kanner (Leo) Associates, Redwood City, Calif.
INFLUENCE OF DISLOCATION PROCESSES ON INITIATION OF FATIGUE CRACKS IN A SURFACE LAYER
Z. Handzel-Powierza and S. Zukowski Washington NASA Aug. 1976 19 p refs Transl. into ENGLISH from Rozpr. Inz. (Poland), vol. 23, no. 2, 1975 p 229-238
(Contract NASw-2790)
(NASA-TT-F-17140) Avail: NTIS HC $3.50 CSCL 13M

The reasons causing early plastic deformations of the surface of crystals and the influence of this layer on the work hardening and decohesion of metals are analyzed. A new dislocation model for the fatigue of materials is presented, in which the dislocation

density is related to the number of stress alternations and to the maximum and minimum stresses in the cycles. Author

N76-28585# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
STABILITY OF CIRCULAR CYLINDRICAL SHELLS UNDER TRANSIENT AXIAL EMPULSIVE LOADING
David Gary Zimcik Mar. 1976 137 p refs
(UTIAS-206) Avail: NTIS HC $6.00

The buckling response of thin walled, circular cylindrical shells subjected to dynamic, transient, axial, squarewave loading of varying time duration was studied. Accurately made shell models were tested in a dynamic loading apparatus, capable of generating an approximate square wave stress input with independent control of stress magnitude and time duration. The shell specimens were fabricated from a birefringent liquid epoxy plastic using the spin casting technique. These included geometrically near perfect, and asymmetric imperfect models. The latter test models required the development of a special manufacturing process which is described in detail. The experimental results indicated an increase in the dynamic buckling stress above the static value (from 10% to 75%) for both perfect and relatively imperfect cylindrical shells subjected to transient square pulse loading. Author

N76-28586# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPTIMIZATION OF REINFORCED CYLINDRICAL SHELLS, INHOMOGENEOUS OVER THE THICKNESS
V. L. Narusberg, R. B. Rikards, and G. A. Teters [1975] 7 p refs Transl. into ENGLISH from Mekh. Polim (USSR), no. 2, 1976 p 298-303
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The synthesis of an optimal multilayer shell with a packet of elementary layers inhomogeneous over the thickness is considered. Particular problems of optimizing a cylindrical sandwich shell, operating at dynamic and static stability, are solved numerically. Optimal variants of the layer arrangement in the model under consideration are compared with optimal solutions. Author

N76-28587# Lockheed Missiles and Space Co., Palo Alto, Calif.
MINIMIZATION OF THE MASS OF CYLINDRICAL SHELLS FROM A COMPOSITE MATERIAL WITH AN ELASTIC CORE UNDER A COMBINED LOAD AND OPERATING AT STRENGTH AND STABILITY
R. S. Lukoshevichius, R. B. Rikards, and G. A. Teters [1976] 10 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), no. 2, 1976 p 298-303
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The mass of a multiplayer cylindrical shell from a composite material with an elastic core operating at strength and stability under the combined effect of axial compression and external pressure is minimized. The problem is formulated as a nonlinear programming problem and is solved by Rosen's gradient projection method. The strength of the material is established from a strength analysis of the layers of the whole packet. Rupture of an individual layer is determined by means of the Malmeister criterion. The shell structure for different magnitudes of the external loads and the dependence of the minimal mass on core stiffness, and on the volume reinforcement coefficient are investigated in numerical examples. Author

42 GEOSCIENCES (GENERAL)

N76-28588*# Stanford Univ., Calif. Inst. for Plasma Research.
SOLAR ACTIVITY, GEOMAGNETIC FIELD AND TERRESTRIAL WEATHER
J. W. Knight and P. A. Sturrock Jul. 1976 10 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-148477; SU-IPR-667) Avail: NTIS HC $3.50 CSCL 08E

There is strong evidence for a causal connection between the interplanetary magnetic field and geomagnetic activity, and some evidence for a connection (possibly indirect) between the interplanetary magnetic field structure and atmospheric vorticity. The interplanetary magnetic field originates in the sun and exhibits long-lived sector structure with a fairly well defined synodic rotation period of approximately 27.1 days. It would therefore appear that an independent test of these associations could be obtained by means of spectral analysis. A comparison of least squares spectra reveals a feature, with period of order 27.1 days, common to both the geomagnetic activity index and the vorticity area index, lending support to the hypothesis that the sun can affect day-by-day terrestrial weather. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-28589 Kentucky Univ., Lexington.
HYDROLOGIC AND ECONOMIC MODELS IN RESERVOIR DESIGN Ph.D. Thesis
Daniel Irvin Carey 1975 189 p
Avail: Univ. Microfilms Order No. 76-16584

Recent studies have indicated the need for development of surface water supplies in Kentucky. Rising resource costs make economically efficient reservoir designs increasingly important. Some methods in water supply reservoir design that increase system benefits are presented. Two major factors influencing reservoir design were studied: (1) estimated future streamflow into the reservoir and (2) demands placed on the reservoir. To assess the reliability of a design, the use of mathematical models to simulate stream flow was undertaken. Data on rural residential water demand in Kentucky has indicated that a price-demand relationship exists. The value of utilizing price-demand information in reservoir design studies was considered. Three pricing policies were examined and their effect on reservoir design was determined. It was found that the use of the conservation pricing policies substantially reduces storage requirements while providing increased, demonstrable net benefits to the community, and that conservation pricing policies substantially lowered the average price paid for water. Dissert. Abstr.

N76-28590 Kansas Univ., Lawrence.
SOIL MOISTURE AND TEMPERATURE REGIMES AND THEIR IMPORTANCE TO MICROWAVE REMOTE SENSING OF SOIL WATER Ph.D. Thesis
Josef Cihlar 1975 167 p
Avail: Univ. Microfilms Order No. 76-16703

Microwave remote sensing of soil moisture was studied, with particular attention to bare soil temperature and moisture regimes and their impact on the microwave technique. A layered water balance model was developed for determining soil water contents and their changes in the upper zone (top 30 cm of soil), while soil moisture regime characteristics at greater depths and those near the surface during the diurnal cycle were studied using experimental measurements. Soil temperature and its variations due to several parameters were investigated by means of a simulation model. Using the two models, moisture and temperature profiles of a hypothetical soil located at mid-latitudes were generated, analyzed, and subsequently used for computing microwave soil parameters at three frequencies (1.4 GHz, 4.0 GHz, 10.0 GHz) for a clear-sky summer day. Dissert. Abstr.

N76-28591 Wisconsin Univ., Madison.
THE NATURE, FUNCTION AND DESIGN CONCEPTS OF MULTI-PURPOSE CADASTRES Ph.D. Thesis
John Douglas McLaughlin 1975 528 p
Avail: Univ. Microfilms Order No. 76-8599

A broad conceptualization of the nature and function of the multi-purpose cadastre within a North American setting is first developed. Methods for creating and maintaining cadastral parcels and records are developed. An approach for recording land transfers is formulated. The desirability of relating land tenure information to other types of land information is examined. Design

concepts required to implement the multi-purpose cadastre concept are then analyzed. Based upon an examination of efforts to develop cadastral systems in the Maritime Provinces of Canada, Massachusetts and Wisconsin, several necessary elements in a cadastral system are identified and analyzed: (1) a spatial framework; (2) a large scale mapping base; (3) a positive title and boundary registration process; and (4) an integrated information storage and retrieval process. Criteria for developing and implementing these elements are proposed. A program for implementing the multipurpose cadastre over a finite period of time is formulated. Dissert. Abstr.

N76-28592 Illinois Univ., Urbana.
RATIONAL DESIGN FOR CLOSE-RANGE PHOTOGRAMMETRY Ph.D. Thesis
Genaro Tolentino Marzan 1976 228 p
Avail: Univ. Microfilms Order No. 76-16161

A method of optimizing the design of a close-range photogrammetry system was sought. A mathematical formulation expressing the standard errors of object space coordinates was developed. Tests confirmed that the formulas are sufficient estimators of the achievable accuracy of a given system, and effective tools to determine the parameters of a system needed to achieve a required accuracy. A preliminary design of the data acquisition system is first developed and a method of data reduction and processing is selected. The values of the resulting parameters are used to give estimates of accuracy. Values of the expected mean square residuals of photo coordinates can be obtained from existing data, test runs, or by modeling using a Bayesian updating process. Proper combinations of convergence and overlap angle needed for an optimum design are tabulated. A computer program for the application of the Direct Linear Transformation method of solving colinearity equations is also included. Dissert. Abstr.

N76-28593*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Final Report
Keenan Lee, Principal Investigator, Gary L. Prost, Daniel H. Knepper, Don L. Sawatzky, David Huntley, and Robert J. Weimer Dec. 1975 638 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13394)
(E76-10383; NASA-CR-144513; Rept-75-7) Avail: NTIS HC $16.25 CSCL 08F

The author has identified the following significant results. Skylab photographs are superior to ERTS images for photogeologic interpretation, primarily because of improved resolution. Lithologic contacts can be detected consistently better on Skylab S190A photos than on ERTS images. Color photos are best; red and green band photos are somewhat better than color-infrared photos; infrared band photos are worst. All major geologic structures can be recognized on Skylab imagery. Large folds, even those with very gentle flexures, can be mapped accurately and with confidence. Bedding attitudes of only a few degrees are recognized; vertical exaggeration factor is about 2.5X. Mineral deposits in central Colorado may be indicated on Skylab photos by lineaments and color anomalies, but positive identification of these features is not possible. S190A stereo color photography is adequate for defining drainage divides that in turn define the boundaries and distribution of ground water recharge and discharge areas within a basin.

N76-28594*# Geological Survey, Denver, Colo.
DISCRIMINATION OF GEOLOGIC MATERIALS USING SKYLAB S-192 DATA, PART 3 Final Report
Howard A. Pohn, Principal Investigator [1975] 6 p refs Sponsored by NASA EREP
(E76-10405; NASA-CR-148218) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-28595*# Geological Survey, Reston, Va.
DETECTION AND MAPPING OF MINERALIZED AREAS IN THE CORTEZ-UINTA BELT, UTAH-NEVADA, USING COMPUTER-ENHANCED ERTS IMAGERY Progress Report
Lawrence C. Rowan, Principal Investigator 1 Jun. 1976 3 p ERTS
(E76-10410; NASA-CR-147793) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. An approach to obtain spatial precision utilizes large scale black and white ratio images with high geometric precision. These images have a precision of .005 inch across the diagonals. Evaluation of a color ratio composite image of south central Nevada using ratio images recorded at this scale shows that the respective pixels are registered throughout the scene. Thus reconnaissance mapping can be carried out for the entire scene at 1:300,000 scale and then at larger scales by analyzing photographic enlargements of the original color ratio composite image. The advantages to this approach are elimination of repetitive computer processing and considerable flexibility as to specific scales.

N76-28596*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
UTILIZATION OF SATELLITE DATA FOR INVENTORYING PRAIRIE PONDS AND LAKES. LANDSAT-1 DATA WERE USED TO DISCRIMINATE PONDS AND LAKES FOR WATERFOWL MANAGEMENT
David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. (ERIM, Ann Arbor, Mich.) [1975] 10 p refs Repr. from Photogrammetric Engr. and Remote Sensing, v. 42, no. 5, May 1976 p 685-694 ERTS
(NASA Order S-70243-AG-4; Contract DI-14-16-0008-75)
(E76-10411; NASA-CR-147654) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. The mapping of open water as an indicator of waterfowl habitat quality was carried out by using two different recognition techniques, a single waveband thresholding approach and a multiple waveband approach termed proportion estimation. The single waveband technique has proven simple to implement. Its computer algorithm was rapid and accurately recognized prairie lakes and large ponds. The resultant products of this processing technique were thematic maps and statistical tabulations describing open surface water conditions. The maps served to portray visually the location and frequency of surface water bodies but usually necessitated additional interpretation.

N76-28597*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC CALIBRATION OF EREP IMAGERY AND ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS Final Report
Edward F. Yost, Principal Investigator Dec. 1975 321 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57918 EREP
(Contract NAS9-13308)
(E76-10418; NASA-CR-147469) Avail: NTIS HC $9.75 CSCL 08J

The author has identified the following significant results. The first part of the study resulted in photographic procedures for making multispectral positive images which greatly enhance the color differences in land detail using an additive color viewer. An additive color analysis of the geologic features near Willcox, Arizona using enhanced black and white multispectral positives allowed compilation of a significant number of unmapped geologic units which do not appear on geologic maps of the area. The second part demonstrated the feasibility of utilizing Skylab remote sensor data to monitor and manage the coastal environment by relating physical, chemical, and biological ship sampled data to S190A, S190B, and S192 image characteristics. Photographic reprocessing techniques were developed which greatly enhanced subtle low brightness water detail. Using these photographic contrast-stretch techniques, two water masses having an extinction coefficient difference of only 0.07 measured simultaneously with the acquisition of S190A data were readily differentiated.

N76-28598*# Geological Survey, Bloomington, Ind.
APPLICATION OF EREP IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN COAL MINING AND MINING-ENVIRONMENTAL PROBLEMS IN INDIANA Final Report, Apr. 1973 - Apr. 1975
C. E. Wier, Principal Investigator, Richard L. Powell, Roger V. Amato (Earth Satellite Corp., Washington, D. C.), Orville R. Russell (Earth Satellite Corp., Washington, D. C.), and Kenneth R. Martin (Earth Satellite Corp., Washington, D. C.) Oct. 1975 57 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13358)
(E76-10419; NASA-CR-144495) Avail: NTIS HC $4.50 CSCL 08I

The author has identified the following significant results. This investigation evaluated the applicability of a variety of sensor types, formats, and resolution capabilities to the study of both fuel and nonfuel mined lands. The image reinforcement provided by stereo viewing of the EREP images proved useful for identifying lineaments and for mined lands mapping. Skylab S190B color and color infrared transparencies were the most useful EREP imagery. New information on lineament and fracture patterns in the bedrock of Indiana and Illinois extracted from analysis of the Skylab imagery has contributed to furthering the geological understanding of this portion of the Illinois basin.

N76-28599*# Utah Univ., Salt Lake City.
SUMMARY OF SPACE IMAGERY STUDIES IN UTAH AND NEVADA
M. LeRoy Jensen, Principal Investigator [1975] 45 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13322)
(E76-10420; NASA-CR-147818) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. An enhanced enlargement of a S190B color image at a scale of 1/19,200 of the Bingham porphyry copper deposit has compared a geological map of the area with the space imagery map as fair for the intrusion boundaries and total lack of quality for mapping the sediments. Hydrothermal alteration is only slightly evident on space imagery at Bingham, but in the Tintic mining district and the volcanic piles of the Keg and Thomas ranges, Utah, hydrothermal alteration is readily mapped on color enlargements of S190B. Several sites of calderas were recognized and new ones located on space imagery. One of the tools developed is a mercury soil-gas analyzer that is becoming significant as an aid in locating hidden mineralized zones which were suggested from space imagery. In addition, this tool is a prime aid in locating and better delineating geothermal sites.

N76-28600*# Stockholm Univ. (Sweden).
ACCUMULATION OF BLUE-GREEN ALGAE IN THE SURFACE WATER OF THE NORTHERN BALTIC, 6 AUGUST 1975, GENERATED FROM THE CCT-TAPE MSS 5 (ID 2196-0917200) BY A HERTZ INK-JET PLOTTER CONNECTED TO A APDP 11/40 COMPUTER AT FOA 3 Quarterly Progress Report
Bengt-Owe Jansson and Bo G. Nyqvist, Principal Investigators [1975] 16 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10423; NASA-CR-148299) Avail: NTIS HC $3.50 CSCL 06C

There are no author-identified significant results in this report.

N76-28601*# Spectral Africa (Pty) Ltd., Randfontein (Republic of South Africa).
MONITORING THE GROWTH OR DECLINE OF VEGETATION ON MINE DUMPS Final Report, Jun. 1972 - Dec. 1975
B. P. Gilbertson, Principal Investigator Dec. 1975 144 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10424; NASA-CR-148300; Rept-74/1) Avail: NTIS HC $6.00 CSCL 08F

The author has identified the following signficant results. It was established that particular mine dumps throughout the entire test area can be detected and identified. It was also established that patterns of vegetative growth on the mine dumps can be recognized from a simple visual analysis of photographic images. Because vegetation tends to occur in patches on many mine dumps, it is unsatisfactory to classify complete dumps into categories of percentage vegetative cover. A more desirable approach is to classify the patches of vegetation themselves. The coarse resolution of conventional densitometers restricts the accuracy of this procedure, and consequently a direct analysis of ERTS CCT's is preferred. A set of computer programs was written to perform the data reading and manipulating functions required for basic CCT analysis.

N76-28602*# Maden Tetkik ve Arma Enstitusu, Ankara (Turkey).
NATIONAL PROJECT FOR THE EVALUATION OF ERTS IMAGERY APPLICATIONS TO VARIOUS EARTH RESOURCES PROBLEMS OF TURKEY Progress Report, 1 Jan. - 1 Mar. 1976
Sadrettin Alpan, Principal Investigator 1 Mar. 1976 22 p Sponsored by NASA Original contains color illustrations ERTS
(E76-10425; NASA-CR-148301; PR-2) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. It is observed that LANDSAT images can be used in preparing an accurate tectonic map of the study areas. These images are most useful in geological mapping areas where vegetation cover is sparse. LANDSAT images can be used to identify and separate evergreens and trees with leaves, and they can successfully delineate boundaries of forestry areas. Water holding capacity of the soil, internal and external drainage, vegetation pattern, irrigated and nonirrigated land, and fallow and planted fields are also detected on the LANDSAT imagery.

N76-28603*# Mekong Committee Secretariat, Bangkok (Thailand).
AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report
W. J. VanDerOord, Principal Investigator Jun. 1976 31 p refs Sponsored by NASA ERTS
(E76-10426; NASA-CR-148302; Rept-2) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N76-28604*# Alaska Univ., Fairbanks.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA Quarterly Progress Report
William J. Stringer, Principal Investigator [1975] 53 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10428; NASA-CR-148304; QPR-15) Avail: NTIS HC $4.50 CSCL 08L

There are no author-identified significant results in this report.

N76-28605*# South Dakota State Univ., Brookings. Remote Sensing Inst.
INVESTIGATION OF REMOTE SENSING TECHNIQUES AS INPUTS TO OPERATIONAL RESOURCE MANAGEMENT MODELS Interim Report, 11 Mar. - 10 Jun. 1976
Fred A. Schmer, Principal Investigator and Robert E. Isakson Jul. 1976 41 p refs ERTS
(Contract NAS5-20982)
(E76-10429; NASA-CR-148305; SDSU-RSI-76-05; Rept-5) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N76-28606*# Army Construction Engineering Research Lab., Champaign, Ill.
EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIR ON THE ENVIRONMENT AND ECOLOGY

Progress Report, 1 Apr. - 30 Jun. 1976
R. K. Jain, Principal Investigator 6 Jul. 1976 2 p ERTS
(E76-10430; NASA-CR-148306) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-28607*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 1 Apr. - 30 Jun. 1976
David S. Gilmer, Principal Investigator 6 Jul. 1976 20 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-54049-A)
(E76-10431; NASA-CR-148307) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. A newly developed software system for generating statistics on surface water features was tested using LANDSAT data acquired previous to 1975. This software test provided a satisfactory evaluation of the system and also allowed expansion of data base on prairie water features. The software system recognizes water on the basis of a classification algorithm. This classification is accomplished by level thresholding a single near infrared data channel. After each pixel is classified as water or nonwater, the software system then recognizes ponds or lakes as sets of contiguous pixels or as single isolated pixels in the case of very small ponds. Pixels are considered to be contiguous if they are adjacent between successive scan lines. After delineating each water feature, the software system then assigns the feature a position based upon a geographic grid system and calculates the feature's planimetric area, its perimeter, and a parameter known as the shape factor.

N76-28608*# Geological Survey, Iowa City, Iowa.
LAND CLASSIFICATION OF SOUTH-CENTRAL IOWA FROM COMPUTER ENHANCED IMAGES Progress Report, 3 Oct. 1975 - 3 Feb. 1976
James R. Lucas, Principal Investigator, James V. Taranik (EROS Data Center, Sioux Falls, S. D.), and Frederic C. Billingsley (JPL) 3 Feb. 1975 60 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10432; NASA-CR-148308; Rept-4) Avail: NTIS HC $4.50 CSCL 08B

There are no author-identified singificant results in this report.

N76-28609*# Nebraska Univ., Lincoln. Conservation and Survey Div.
APPLICATION OF LANDSAT IMAGERY IN LAND USE INVENTORY AND CLASSIFICATION IN NEBRASKA Progress Report, 10 Mar. - 10 Jun. 1976
Marvin P. Carlson, Principal Investigator and Paul M. Seevers 10 Jun. 1976 5 p ERTS
(Contract NAS5-20814)
(E76-10433; NASA-CR-148309; Rept-5) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-28610*# California Univ., Berkeley. Space Sciences Lab.
SKYLAB DATA AS AN AID TO RESOURCE MANAGEMENT IN NORTHERN CALIFORNIA Final Report, 1 Oct. 1974 - 15 Oct. 1975
R. N. Colwell, Principal Investigator 15 Oct. 1975 44 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14420)
(E76-10434; NASA-CR-144487) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N76-28611*# ECON, Inc., Princeton, N.J.
THE VALUE OF FORAGE MEASUREMENT INFORMATION IN RANGELAND MANAGEMENT Final Report
Keith R. Lietzke 30 Aug. 1975 159 p refs
(Contract NASw-2558)
(NASA-CR-148152; Rept-75-127-4) Avail: NTIS HC $6.75 CSCL 02B

An economic model and simulation are developed to estimate the potential social benefit arising from the use of alternative measurement systems in rangeland management. In order to estimate these benefits, it was necessary to model three separate systems: the range environment, the rangeland manager, and the information system which links the two. The rancher's decision-making behavior is modeled according to sound economic principles. Results indicate substantial potential benefits, particularly when used in assisting management of government-operated ranges; possible annual benefits in this area range from $20 to $46 million, depending upon the system capabilities assumed. Possible annual benefit in privately-managed stocker operations range from $2.8 to $49.5 million, depending upon where actual rancher capabilities lie and what system capabilities are assumed. Author

N76-28612*# Battelle Columbus Labs., Ohio.
COASTAL DATA ACCUMULATION POTENTIALS FOR OPERATIONAL SYSTEMS USING AIRPLANES Final Report
M. B. Kuhner 15 Aug. 1975 26 p
(Contract NASw-2800)
(NASA-CR-148473; BCL-OA-TFR-76-1) Avail: NTIS HC $4.00 CSCL 05B

Potential users of SEASAT for remote sensing of coastal zone phenomena have established a need for resolutions beyond those attainable with SEASAT-A. One method of obtaining higher resolutions would be to fly the instruments aboard airplanes rather than a satellite. The number of aircraft that would be required is estimated along with the rate at which data would be accumulated. Only the East Coast from Maine to Key West is considered. Three different coverage widths are used. The narrowest area is wide enough to cover all bay and estuary regions along the coast; a wider area includes all ocean out to twelve nautical miles from the coast; the maximum size area considered extends out to 200 nautical miles from the coast. Author

N76-28613*# Battelle Columbus Labs., Ohio.
FEASIBILITY OF SATELLITE INTERFEROMETRY FOR SURVEILLANCE, NAVIGATION, AND TRAFFIC CONTROL Final Report
S. Gopalapillai, G. T. Ruck, and A. G. Mourad Feb. 1976 165 p refs
(Contract NASw-2800)
(NASA-CR-148471; BCL-OA-TFR-76-2) Avail: NTIS HC $6.75 CSCL 17G

The feasibility of using a satellite borne interferometry system for surveillance, navigation, and traffic control applications was investigated. The evaluation was comprised of: (1) a two part systems analysis (software and hardware); (2) a survey of competitive navigation systems (both experimental and planned); (3) a comparison of their characteristics and capabilities with those of an interferometry system; and (4) a limited survey of potential users to determine the variety of possible applications for the interferometry system and the requirements which it would have to meet. Five candidate or 'strawman' interferometry systems for various applications with various capabilities were configured (on a preliminary basis) and were evaluated. It is concluded that interferometry in conjunction with a geostationary satellite has an inherent ability to provide both a means for navigation/position location and communication. It offers a very high potential for meeting a large number of user applications and requirements for navigation and related functions. Author

N76-28614*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 1: SUMMARY AND CONCLUSIONS Final Report, Feb. 1974 - Aug. 1975

31 Aug. 1975 34 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148494; Rept-75-125-1B-Vol-1) Avail: NTIS HC $4.00 CSCL 05C

A summary is presented of the economic benefits that can be derived from using the SEASAT Satellite System. A statement of the major findings of case studies of the practical applications of the SEASAT program to the following areas is given: (1) offshore oil and natural gas industry, (2) ocean mining, (3) coastal zones, (4) oil exploration in Arctic regions, (5) ocean fishing, and (6) ports and harbors. Also given is a description of the SEASAT System and its performance. A computer program, used to optimize SEASAT System's costs and operational requirements, is also considered. Author

N76-28615*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 2: THE SEASAT SYSTEM DESCRIPTION AND PERFORMANCE Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 99 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148495; Rept-75-125-2A-Vol-2) Avail: NTIS HC $5.00 CSCL 05C

Results are presented of preliminary trade-off studies of operational SEASAT systems. The trade-off studies were used as the basis for the estimation of costs and net benefits of the operational SEASAT system. Also presented are the preliminary results of simulation studies that were designed to lead to a measure of the impact of SEASAT data through the use of numerical weather forecast models. Author

N76-28616*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 3: OFF-SHORE OIL AND NATURAL GAS INDUSTRY CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 147 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148496; Rept-75-125-3B-Vol-3) Avail: NTIS HC $6.00 CSCL 05C

The economic benefits of improved ocean condition, weather and ice forecasts by SEASAT satellites to the exploration, development and production of oil and natural gas in the offshore regions are considered. The results of case studies which investigate the effects of forecast accuracy on offshore operations in the North Sea, the Celtic Sea, and the Gulf of Mexico are reported. A methodology for generalizing the results to other geographic regions of offshore oil and natural gas expioration and development is described. Author

N76-28617*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 4: OCEAN MINING CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 43 p refs
(Contract NASw-2558)
(NASA-CR-148497; Rept-75-125-4B-Vol-4) Avail: NTIS HC $4.00 CSCL 05C

The results of a study of the weather sensitive features of near shore and deep water ocean mining industries are described. Problems with the evaluation of economic benefits for the deep water ocean mining industry are attributed to the relative immaturity and highly proprietary nature of the industry. Case studies on the gold industry, diamond industry, tin industry and sand and gravel industry are cited. Author

N76-28618*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 5: COASTAL ZONES CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 91 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148498; Rept-75-125-5B-Vol-5) Avail: NTIS HC $5.00 CSCL 05C

The economic losses sustained in the U.S. coastal zones were studied for the purpose of quantitatively establishing economic benefits as a consequence of improving the predictive quality of destructive phenomena in U.S. coastal zones. Improved prediction of hurricane landfall and improved experimental knowledge of hurricane seeding are discussed. Author

N76-28619*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 6: ARCTIC OPERATIONS CASE STUDY AND GENERALIZATION Final Report, Feb, 1974 - Aug. 1975
31 Aug. 1975 77 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148499; Rept-75-125-6B-Vol-6) Avail: NTIS HC $5.00 CSCL 05C

The hypothetical development and transportation of Arctic oil and other resources by ice breaking super tanker fleets to the continental East Coast are discussed. The utilization of SEASAT ice mapping data is shown to contribute to a more effective transportation operation through the Arctic ice by reducing transportation costs as a consequence of reduced transit time per voyage.

N76-28620*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 7: MARINE TRANSPORATION CASE STUDY Final Report, Feb. 1974 - Aug. 1975
Oct. 1975 289 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148500; Rept-75-125-7A-Vol-7) Avail: NTIS HC $9.25 CSCL 05C

The studies conducted of the potential use of SEASAT ocean condition data and resulting forecasts by dry cargo ships and tankers reached the following conclusions. The SEASAT ocean condition data and resulting forecasts could be usefully employed to route ships around storms, thereby resulting in reduced adverse weather damage, time loss and the related operating costs, and occasional catastrophic losses. These benefits are incremental benefits beyond those which present and future conventional ship routing procedures can supply. The values of the benefits are listed. Author

N76-28621*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 8: OCEAN FISHING CASE STUDY Final Report, Feb. 1974 - Aug. 1975
Oct. 1975 131 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148501; Rept-75-125-8A-Vol-8) Avail: NTIS HC $6.00 CSCL 05C

The potential application of SEASAT data with regard to ocean fisheries is discussed. Tracking fish populations, indirect assistance in forecasting expected populations and assistance to fishing fleets in avoiding costs incurred due to adverse weather through improved ocean conditions forecasts were investigated. Case studies on fisheries in the United States and Canada are cited. Author

N76-28622*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 9: PORTS AND HARBORS CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 201 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148502; Rept-75-125-9B-Vol-9) Avail: NTIS HC $7.75 CSCL 05C

This case study and generalization quantify benefits made possible through improved weather forecasting resulting from the integration of SEASAT data into local weather forecasts. The major source of avoidable economic losses to shipping from inadequate weather forecasting data is shown to be dependent on local precipitation forecasting. The ports of Philadelphia and Boston were selected for study. Author

N76-28623*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 10: THE SATIL 2 PROGRAM (A PROGRAM FOR THE EVALUATION OF THE COSTS OF AN OPERATIONAL SEASAT SYSTEM AS A FUNCTION OF OPERATIONAL REQUIREMENTS AND RELIABILITY Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 206 p refs 10 Vol.

(Contract NASw-2558)
(NASA-CR-148503; Rept-75-125-10B-Vol-10) Avail: NTIS HC $7.75 CSCL 05C

The SATIL 2 computer program was developed to assist with the programmatic evaluation of alternative approaches to establishing and maintaining a specified mix of operational sensors on spacecraft in an operational SEASAT system. The program computes the probability distributions of events (i.e., number of launch attempts, number of spacecraft purchased, etc.), annual recurring cost, and present value of recurring cost. This is accomplished for the specific task of placing a desired mix of sensors in orbit in an optimal fashion in order to satisfy a specified sensor demand function. Flow charts are shown, and printouts of the programs are given. Author

N76-28624*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
USE OF REMOTE SENSING IN AGRICULTURE Technical Report, Jul. 1973 - Dec. 1974
David E. Pettry and N. L. Powell May 1975 35 p refs
(Contract NAS6-2388)
(NASA-CR-137477) Avail: NTIS HC $4.00 CSCL 02C

The remote sensing studies of (a) cultivated peanut areas in Southeastern Virginia; (b) studies at the Virginia Truck and Ornamentals Research Station near Painter, Virginia, the Eastern Virginia Research Station near Warsaw, Virginia, the Tidewater Research and Continuing Education Center near Suffolk, Virginia, and the Southern Piedmont Research and Continuing Education Center Blackstone, Virginia; and (c) land use classification studies at Virginia Beach, Virginia are presented. The practical feasibility of using false color infrared imagery to detect and determine the areal extent of peanut disease infestation of Cylindrocladium black rot and Sclerotinia blight is demonstrated. These diseases pose a severe hazard to this major agricultural food commodity. The value of remote sensing technology in terrain analyses and land use classification of diverse land areas is also investigated. Continued refinement of spectral signatures of major agronomic crops and documentation of pertinent environmental variables have provided a data base for the generation of an agricultural-environmental prediction model. Author

N76-28625*# Earth Satellite Corp., Washington, D.C.
EARTHSAT SPRING WHEAT YIELD SYSTEM TEST 1975 Final Report
Apr. 1976 491 p refs
(Contract NAS9-14655)
(NASA-CR-147711; E/S-1052) Avail: NTIS HC $12.50 CSCL 02C

The results of an operational test of the EarthSat System during the period 1 June - 30 August 1975 over the spring wheat regions of North Dakota, South Dakota, and Minnesota are presented. The errors associated with each sub-element of the system during the operational test and the sensitivity of the complete system and each major functional sub-element of the system to the observed errors were evaluated. Evaluations and recommendations for future operational users of the system include: (1) changes in various system sub-elements, (2) changes in the yield model to affect improved accuracy, (3) changes in the number of geobased cells needed to develop an accurate aggregated yield estimate, (4) changes associated with the implementation of future operational satellites and data processing systems, and (5) detailed system documentation. Author

N76-28626*# Purdue Univ., Lafayette, Ind.
EVALUATION OF SURFACE WATER RESOURCES FROM MACHINE-PROCESSING OF ERTS MULTISPECTRAL DATA
P. W. Mausel, W. J. Todd, M. F. Baumgardner, R. A. Mitchell, and J. P. Cook 1976 7 p
(Contract NAS9-14016)
(NASA-CR-147787; LARS-Inform-Note-030576) Avail: NTIS HC $3.50 CSCL 08H

The surface water resources of a large metropolitan area, Marion County (Indianapolis), Indiana, are studied in order to assess the potential value of ERTS spectral analysis to water resources problems. The results of the research indicate that all surface water bodies over 0.5 ha were identified accurately from ERTS multispectral analysis. Five distinct classes of water were identified and correlated with parameters which included: degree of water siltiness; depth of water; presence of macro and micro biotic forms in the water; and presence of various chemical concentrations in the water. The machine processing of ERTS spectral data used alone or in conjunction with conventional sources of hydrological information can lead to the monitoring of area of surface water bodies; estimated volume of selected surface water bodies; differences in degree of silt and clay suspended in water and degree of water eutrophication related to chemical concentrations. Author

N76-28627*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN ANALYSIS OF METROPOLITAN LAND-USE BY MACHINE PROCESSING OF EARTH RESOURCES TECHNOLOGY SATELLITE DATA
P. W. Mausel, W. J. Todd, and M. F. Baumgardner 1976 12 p refs
(Contract NAS9-14016)
(NASA-CR-147788; LARS-Inform-Note-031276) Avail: NTIS HC $3.50 CSCL 08B

A successful application of state-of-the-art remote sensing technology in classifying an urban area into its broad land use classes is reported. This research proves that numerous urban features are amenable to classification using ERTS multispectral data automatically processed by computer. Furthermore, such automatic data processing (ADP) techniques permit areal analysis on an unprecedented scale with a minimum expenditure of time. Also, classification results obtained using ADP procedures are consistent, comparable, and replicable. The results of classification are compared with the proposed U. S. G. S. land use classification system in order to determine the level of classification that is feasible to obtain through ERTS analysis of metropolitan areas. Author

N76-28628*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROGRAPHIC CHARTING FROM LANDSAT SATELLITE: A COMPARISON WITH AIRCRAFT IMAGERY
Elizabeth M. Middleton (Computer Sciences Corp., Silver Spring, Md.) and John L. Barker May 1976 10 p refs Proposed for Presentation at Ocean 76 Conf., Washington, D. C., 14-16 Sept. 1976
(NASA-TM-X-71146; X-923-76-111) Avail: NTIS HC $3.50 CSCL 08H

The relative capabilities of two remote-sensing systems in measuring depth and, consequently, bottom contours in sandy-bottomed and sediment-laden coastal waters were determined quantitatively. The multispectral scanner (MSS), orbited on the LANDSAT-2 Satellite, and the ocean color scanner (OCS), flown on U-2 aircraft, were used. Analysis of imagery taken simultaneously indicates a potential for hydrographic charting of marine coastal and shallow shelf areas, even when water turbidity is a factor. Several of the eight optical channels examined on the OCS were found to be sensitive to depth or depth-related information. The greatest sensitivity was in OCS-4(0.544 + or - 0.012 microns) from which contours corresponding to depths up to 12m were determined. The sharpness of these contours and their spatial stability through time suggests that upwelling radiance is a measure of bottom reflectance and not of water turbidity. The two visible channels on LANDSAT's MSS were less sensitive in the discrimination of contours, with depths up to 8m in the high-gain mode (3x) determined in MSS-4(0.5 to 0.6 microns). Author

N76-28629*# Geological Survey, Sioux Falls, S. Dak.
LINEAMENTS ON SKYLAB PHOTOGRAPHS: DETECTION, MAPPING, AND HYDROLOGIC SIGNIFICANCE IN CENTRAL TENNESSEE Final Report
Gerald K. Moore Mar. 1976 87 p refs Original contains color illustrations
(NASA Order H-2810B)
(NASA-CR-149947; Rept-76-196) Avail: NTIS HC $5.00 CSCL 08B

An investigation was carried out to determine the feasibility of mapping lineaments on SKYLAB photographs of central Tennessee and to determine the hydrologic significance of these lineaments, particularly as concerns the occurrence and productiv-

ity of ground water. Sixty-nine percent more lineaments were found on SKYLAB photographs by stereo viewing than by projection viewing, but longer lineaments were detected by projection viewing. Most SKYLAB lineaments consisted of topographic depressions and they followed or paralleled the streams. The remainder were found by vegetation alinements and the straight sides of ridges. Test drilling showed that the median yield of wells located on SKYLAB lineaments were about six times the median yield of wells located by random drilling. The best single detection method, in terms of potential savings, was stereo viewing. Larger savings might be achieved by locating wells on lineaments detected by both stereo viewing and projection. Author

N76-28630*# Scientific Translation Service, Santa Barbara, Calif.
AEROGEOLOGICAL STRUCTURAL STUDY OF THE CARSO MOUNTAINS OF GORIZIA AND TRIEST, OF WESTERN SLOVENIA, AND OF ISTRIA (AND FIRST COMPARISONS WITH THE ERTS-1 AND SKYLAB IMAGES)
Giuliano Piccoli Washington NASA Jul. 1976 56 p refs Transl. into ENGLISH from Mem. Ist. Geol. Mineral. Univ. Padova (Padua), v. 31, 1975 p 1-40
(Contract NASw-2791)
(NASA-TT-F-16730) Avail: NTIS HC $4.50 CSCL 08B

A photogeological structural study of the western Veneto area between the Lake of Garda and the river Brenta is presented. The interferences between the fundamental tectonic directing lines pertinent to the region were observed, and their probable chronological succession was traced. The most important tectonic direction goes under the name of Schio-Vicenza plate and coincides with the principal Dinaric direction (NNE-SSE). Author

N76-28631*# Geological Survey, Reston, Va.
A SURVEY OF THE UTILITY OF SATELLITE MAGNETOMETER DATA FOR APPLICATION TO SOLID-EARTH GEOPHYSICAL AND GEOLOGICAL STUDIES Final Report
Sep. 1975 30 p ref
(NASA Order S-500-29A)
(NASA-CR-144786) Avail: NTIS HC $4.00 CSCL 08G

A survey of potential users of low altitude satellite magnetic measurements for solid-earth and geological studies was conducted. The principal objectives of this survey were to: document the utility and application of the data and resultant products obtained from such a satellite mission, and establish a users committee for the proposed low altitude vector magnetometer satellite. Author

N76-28632*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
LACIE PHASE 1 CLASSIFICATION AND MENSURATION SUBSYSTEM (CAMS) REWORK EXPERIMENT
R. S. Chhikara, E. M. Hsu, and C. J. Liszcz Jun. 1976 13 p
(Contract NAS9-12200)
(NASA-CR-147829; LEC-8655) Avail: NTIS HC $3.50 CSCL 02C

An experiment was designed to test the ability of the Classification and Mensuration Subsystem rework operations to improve wheat proportion estimates for segments that had been processed previously. Sites selected for the experiment included three in Kansas and three in Texas, with the remaining five distributed in Montana and North and South Dakota. The acquisition dates were selected to be representative of imagery available in actual operations. No more than one acquisition per biophase were used, and biophases were determined by actual crop calendars. All sites were worked by each of four Analyst-Interpreter/Data Processing Analyst Teams who reviewed the initial processing of each segment and accepted or reworked it for an estimate of the proportion of small grains in the segment. Classification results, acquisitions and classification errors and performance results between CAMS regular and ITS rework are tabulated. Author

N76-28633*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.
SNOWPACK GROUND TRUTH: RADAR TEST SITE, STEAMBOAT SPRINGS, COLORADO, 8-16 APRIL 1976
Steven Howell, E. Bruce Jones, and Charles F. Leaf Apr. 1976 30 p refs Sponsored in part by AF
(Contract NAS5-22312)
(NASA-CR-144773) Avail: NTIS HC $4.00 CSCL 08L

Ground-truth data taken at Steamboat Springs, Colorado is presented. Data taken during the period April 8, 1976 - April 16, 1976 included the following: (1) snow depths and densities at selected locations (using a Mount Rose snow tube); (2) snow pits for temperature, density, and liquid water determinations using the freezing calorimetry technique and vertical layer classification; (3) snow walls were also constructed of various cross sections and documented with respect to sizes and snow characteristics; (4) soil moisture at selected locations; and (5) appropriate air temperature and weather data. Author

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-28634 Carnegie-Mellon Univ., Pittsburgh, Pa.
REALISTIC LONG TERM ELECTRICAL GENERATION EXPANSION PLANNING IN THE FACE OF FUTURE UNCERTAINTIES Ph.D. Thesis
Poong Eil Juhn 1975 364 p
Avail: Univ. Microfilms Order No. 76-11656

A realistic long term electrical generation expansion planning model composed of multiple fossil units, nuclear units, hydroelectric units and pumped storage units, faced with uncertainties, was developed. The motivation for developing this long term uncertainty model is a recognition of the need to identify realistic expansion alternatives when in the face of uncertain situations that can occur during certain time periods in the future. The linear programming model (LIMIMA) was developed to examine 12 uncertain conditions. The minimum and the maximum number of electrical generating units of each allowable candidate type obtained from the LIMIMA computer code is used as a feasible expansion plan. Each feasible set is checked whether or not it is suitable to supply total system demand, by using the simulation technique. Dissert. Abstr.

N76-28635* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FABRICATION OF POLYCRYSTALLINE SOLAR CELLS ON LOW-COST SUBSTRATES Patent
Ting L. Chu, inventor (to NASA) Issued 8 Jun. 1976 10 p Filed 12 May 1975 Supersedes N76-13597 (14 - 04, p 0470)
(NASA-Case-GSC-12022-1; NASA-Case-GSC-12023-1; US-Patent-3,961,997; US-Patent-Appl-SN-576488; US-Patent-Class-148-174; US-Patent-Class-29-572; US-Patent-Class-136-89; US-Patent-Class-148-175; US-Patent-Class-156-612; US-Patent-Class-156-613; US-Patent-Class-156-614; US-Patent-Class-357-30; US-Patent-Class-357-59; US-Patent-Class-427-86; US-Patent-Class-427-113; US-Patent-Class-427-248; US-Patent-Class-427-249; US-Patent-Class-427-250) Avail: US Patent Office CSCL 10A

A new method of producing p-n junction semiconductors for solar cells was described; the principal objective of this investigation is to reduce production costs significantly by depositing polycrystalline silicon on a relatively cheap substrate such as metallurgical-grade silicon, graphite, or steel. The silicon layer contains appropriate dopants, and the substrates are coated with a diffusion barrier of silica, borosilicate, phosphosilicate, or mixtures of these compounds. Author

N76-28636 Carnegie-Mellon Univ., Pittsburgh, Pa.
ALUMINUM-GALLIUM ARSENIDE HETEROFACE SOLAR

CELLS Ph.D. Thesis
Albert Michael Sekela, Jr. 1976 184 p
Avail: Univ. Microfilms Order No. 76-15974

Aluminum-gallium arsenide heteroface solar cells are studied. The heteroepitaxial layer of aluminum-gallium arsenide is added to the p-n homojunction gallium arsenide solar cell to control the surface recombination velocity. Calculations show that gallium arsenide solar cells with a heteroface layer could have conversion efficiencies exceeding 20%. The wider band gap of gallium arsenide relative to silicon means gallium arsenide cells have better high temperature efficiency, and the heteroface structure allows the series resistance to be reduced for concentration applications without serious loss of conversion efficiency. Dissert. Abstr.

N76-28637 North Carolina State Univ., Raleigh.
A THEORETICAL ANALYSIS OF THE CURRENT VOLTAGE CHARACTERISTICS OF SOLAR CELLS Ph.D. Thesis
Peter Michael Dunbar 1975 253 p
Avail: Univ. Microfilms Order No. 76-14318

Various mechanisms which limit the conversion efficiency of silicon solar cells were identified. A computerized semiconductor device analysis program was used which obtains a complete numerical solution of the general semiconductor device equations including an excess carrier generation rate due to full spectrum solar irradiance. It was found that the specific mechanisms which form the predominant limitations to conversion efficiency are not the same for all variations in geometry and doping utilized in solar cells. In general, the efficiency of solar cells was found to peak within a base resistivity range of 0.1 ohm-cm to 1 ohm-cm. The magnitude of this peak and the base resistivity at which it occurs is a complex function of diffused region life-time, heavy doping effects, bulk region lifetime, and the presence and nature of a back surface field. For base resistivities below this peak range the efficiency decreases, and for base resistivities higher than this peak range the open circuit voltage is degraded. Dissert. Abstr.

N76-28638 Texas Univ., Austin.
GEOLOGIC HABITATS OF GEOTHERMAL ENERGY AND METHODS OF EXPLORATION Ph.D. Thesis
Myron Herbert Dorfman 1975 244 p
Avail: Univ. Microfilms Order No. 76-14437

The worldwide distribution of geothermal resources is classified within the framework of plate tectonics. Reservoir rocks, cap rocks, and fluid characteristics indigenous to various tectonic settings are described. These include continental subduction systems, island arc subduction systems, crustal rift systems, convective mantle plume systems, and geopressured sedimentary basins. Various geophysical techniques under current investigation for identifying and delineating geothermal reservoirs are described with particular emphasis on the self-potential method. Theories of the self-potential method of geophysical exploration are discussed, and results of laboratory and field tests of the self-potential method in geothermal exploration are described. Self-potential surveys appear to be an excellent tool for delineating areas of high heat flow beneath the surface. Field tests indicate that self-potential surveys also represent an important new technique for determining the magnitude and direction of heat movement in thermal floods of petroleum reservoirs. Dissert. Abstr.

N76-28639 Oklahoma Univ., Norman.
TWO DIMENSIONAL CONFIGURATION ANALYSIS OF A FLAT-PLATE SOLAR COLLECTOR Ph.D. Thesis
Prabhaker P. Rao 1975 108 p
Avail: Univ. Microfilms Order No. 76-15807

A two-dimensional theoretical model of a flat-plate solar collector is developed. By means of this model, it is shown using hourly values of weather data, that the collector configuration parameters such as length, tube spacing, plate thickness etc., can be optimized based on least cost Btu of energy absorbed. The performance model obtained is based on a differential formulation. An explicit expression for the average plate temperature is obtained. The thermal losses from the plate surface are considered to be a function of the local plate temperature and the overall loss coefficient is assumed to be constant for the whole plate. A FORTRAN program of the model is developed, whereby, the effects of various parameters on the collector performance and on the cost/Btu of energy absorbed could be studied in a quantitative manner. Dissert. Abstr.

N76-28640 California Univ., Berkeley.
AN INVESTIGATION OF THE CuxS/Cd(1-Y)ZnyS HETEROJUNCTION: A POTENTIALLY LOW-COST, HIGH-EFFICIENCY PHOTOVOLTAIC ENERGY CONVERTER Ph.D. Thesis
Terry Michael Peterson 1975 74 p
Avail: Univ. Microfilms Order No. 76-15340

Heterojunction photovoltaic cells of cuprous sulfide and cadmium-zinc sulfide were made. Cells were also made of cuprous sulfide on single crystal cadmium sulfide and zinc sulfide. The cadmium-zinc sulfide, mixed crystal, cells' properties were found to be superior to the CdS cells' in all respects, except short-circuit current density. In particular, they had higher power conversion efficiencies. It is argued that the higher efficiency of the mixed crystal cells together with the likelihood of their having greater stability than the CdS cell makes them an attractive alternative to other photovoltaic cells for economical solar power conversion. A theoretical model of the cuprous sulfide/2-6 semiconductor heterojunction is developed incorporating explanations of (1) enhancement/quenching data found in two-beam experiments in terms of the rigid-band model of cuprous sulfide; (2) the decrease in short-circuit current in djurleite-CdS cells, in terms of the movement of dislocation arrays required for lattice mismatch accommodation; and (3) the change in barrier height and spectral response of cuprous sulfide-Cd1-yZnyS heterojunctions, as the zinc fraction is increased, in terms of the change in electron affinity of the 2-6 compound. Dissert. Abstr.

N76-28641 Brown Univ., Providence, R.I.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF GRATING TYPE PHOTOVOLTAIC CELLS Ph.D. Thesis
Lish-yann Chen 1975 90 p
Avail: Univ. Microfilms Order No. 76-15616

The design principles and the underlying theory for the grating-type photovoltaic cell is presented. Aluminum-n-silicon alloyed grating-type photovoltaic cells with various grating line widths and line spacings are manufactured. Electrical and optical characteristics of these cells are taken. These cells can have comparable or even greater shortcircuit currents than conventional silicon photovoltaic cells. Due to their large leakage currents, these cells have lower open-circuit voltages than conventional silicon cells. The grating-type cell is usually a blue-shifted cell relative to a conventional cell. It has higher response to blue-ultraviolet light and lower response to red-infrared light. Dissert. Abstr.

N76-28642*# Yardney Electric Corp., Pawcatuck, Conn.
DEVELOPMENT AND FABRICATION OF LARGE VENTED NICKEL-ZINC CELLS Final Report
C. Philip Donnel, III Dec. 1975 60 p
(Contract NAS3-18515)
(NASA-CR-134967) Avail: NTIS HC $4.50 CSCL 10C

A preliminary cell design for a 300AH vented nickel-zinc cell was established based on volume requirements and cell component materials selected by NASA Lewis Research Center. A 100AH cell configuration was derived from the 300AH cell design utilizing the same size electrodes, separators, and cell terminal hardware. The first cells fabricated were four groups of three cells each in the 100AH size. These 100AH experimental nickel-zinc cells had as common components the nickel positive electrodes (GFM), flexible inorganic separator (GFM) bags on the negative electrodes, pressed powder zinc oxide electrodes, and cell containers with hardware. The variations introduced were four differing electrolyte absorber (interseparator) systems used to encase the nickel positive electrodes of each cell group. The four groups of 100AH experimental vented nickel-zinc cells were tested to determine, based on cell performance, the best two interseparator systems. Using the two interseparator systems, two groups of experimental 300AH cells were fabricated. Each group of three cells differed only in the interseparator material used. The six cells were filled, formed and tested to evaluate the interseparator materials and investigate the performance characteristics of the 300AH cell configuration and its components. Author

N76-28643*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GELS AS BATTERY SEPARATORS FOR SOLUBLE ELECTRODE CELLS Patent Application
Dean W. Sheibley and Randall F. Gahn, inventors (to NASA) Filed 20 Jul. 1976 18 p
(NASA-Case-LEW-12364-1; US-Patent-Appl-SN-707124) Avail: NTIS HC $3.50 CSCL 10C

Gels are formed from silica powders and hydrochloric acid. The gels can then be impregnated into a polymeric foam, and the resultant sheet material can then be used in applications where the transport of chloride ions is desired. Specifically disclosed is the utilization of the sheet in electrically rechargeable redox flow cells which find application in bulk power storage systems. NASA

N76-28644*# Kanner (Leo) Associates, Redwood City, Calif.
PHYSICAL CHARACTERIZATION OF SILICON SOLAR CELLS BY DETERMINATION OF SPECTRAL RESPONSE
E. Fabre and M. Mautref Washington NASA Aug. 1976 18 p refs Transl. into ENGLISH from Acta Electron. (France), v. 18, Oct. 1975 p 331-338
(Contract NASw-2790)
(NASA-TT-F-17138) Avail: NTIS HC $3.50 CSCL 10A

Spectral response measurements are shown to be useful tools for assessing solar cells. Data are acquired on minority carrier diffusion length and on the entrance window of the cell, i.e., on the main parameters which govern the overall conversion efficiency. Trap saturation phenomena which lead to an improvement of the apparent minority carrier diffusion length are measured. An electrolytic cell is used to study the influence of different parameters which can affect the shortcircuit current and to establish the best solar cell fabrication process. Author

N76-28645*# International Business Machines Corp., Yorktown Heights, N.Y. Thomas J. Watson Research Center.
THE OPTIMIZATION OF Ga (1-X)Al (X)As-GaAs SOLAR CELLS FOR AIR MASS ZERO OPERATION AND A STUDY OF Ga (1-X)Al (X)As-GaAs SOLAR CELLS AT HIGH TEMPERATURES, PHASE 1 Final Report
H. J. Hovel and J. M. Woodall [1976] 70 p refs
(Contract NAS1-12812)
(NASA-CR-145008) Avail: NTIS HC $4.50 CSCL 10A

The three types of solar cells investigated were: (1) one consisting of a nGaAs substrate, a Zn doped pGaAs region, and a Zn doped Ga(1-x)Al(x)As layer, (2) one consisting of an nGaAs substrate, a Ge doped pGaAs region, and a pGa(1-x)Al(x)As upper layer, and (3) one consisting of an n+GaAs substrate, an nGa(1-x)Al(X)As region, a pGa(1-x)Al(X) As region, and a pGa(1-y)Al(y)As upper layer. In all three cases, the upper alloy layer is thin and of high Al composition in order to obtain high spectral response over the widest possible range of photon energies. Spectral response, capacitance-voltage, current-voltage, diffusion length, sunlight (or the equivalent)-efficiency, and efficiency-temperature measurements were made as a function of device parameters in order to analyze and optimize the solar cell behavior. Author

N76-28646*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECT HEATING SURFACE COMBUSTOR Patent Application
Donald G. Beremand, Lloyd Shure, and Thaddeus S. Mroz, inventors (to NASA) Filed 26 Jul. 1976 13 p
(NASA-Case-LEW-11877-1; US-Patent-Appl-SN-708660) Avail: NTIS HC $3.50 CSCL 10B

A direct heating surface combustor is described that utilizes a non-adiabatic flame to provide a low emission combustion for gas turbines. A fuel-air mixture is directed through a porous wall, the other side of which serves as a combustion surface. A radiant heat sink disposed adjacent to and spaced from the combustion surface controls the combustor flame temperature in order to prevent the formation of oxides of nitrogen. A secondary air flow cools the heat sink. Additionally, up to 100% of secondary air flow is mixed with the combustion products at the direct heating surface combustor to dilute such products thereby reducing exit temperature. However, if less than 100% secondary air is mixed at the combustor, the remainder may be added to the combustion products further downstream. NASA

N76-28647*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE COST OF ENERGY FROM UTILITY-OWNED SOLAR ELECTRIC SYSTEMS. A REQUIRED REVENUE METHODOLOGY FOR ERDA/EPRI EVALUATIONS
Jun. 1976 89 p refs Sponsored in part by ERDA
(Contract NAS7-100)
(NASA-CR-148493; JPL-5040-29; ERDA/JPL-1012-76/3) Avail: NTIS HC $5.00 CSCL 10A

This methodology calculates the electric energy busbar cost from a utility-owned solar electric system. This approach is applicable to both publicly- and privately-owned utilities. Busbar cost represents the minimum price per unit of energy consistent with producing system-resultant revenues equal to the sum of system-resultant costs. This equality is expressed in present value terms, where the discount rate used reflects the rate of return required on invested capital. Major input variables describe the output capabilities and capital cost of the energy system, the cash flows required for system operation amd maintenance, and the financial structure and tax environment of the utility. Author

N76-28648*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIFE CAPABILITY OF THE SILVER ELECTRODE IN ALKALINE ELECTROCHEMICAL CELLS
H. A. Frank 1 Aug. 1976 38 p refs
(Contract NAS7-100)
(NASA-CR-148485; JPL-TM-33-789) Avail: NTIS HC $4.00 CSCL 10C

Estimates of silver electrode degradation rates were made by comparing the recently measured capacities with the reported early life capacities. Chemical analyses were carried out to determine the extent of silver loss from the electrode and its distribution throughout the cell components. The results established that the silver electrode is very stable when stored at reduced temperatures in the range of 0 to -51 C, in which it exhibits a permanent degradation in capacity of 0.5%/year. The results also indicated that the silver electrode is not quite as stable when operated and stored at room temperature, where it exhibits permanent degradation in the range of 3% to 14%/year. These results were employed in predicting the life capability of the proposed new Ag-H2 cell and also in assessing the merits of employing silver electrodes in long-life probe batteries. Author

N76-28649*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE TRANSIENT THERMAL RESPONSE OF A TUBULAR SOLAR COLLECTOR
F. L. Lansing 15 Jul. 1976 44 p refs
(Contract NAS7-100)
(NASA-CR-148488; JPL-TM-33-781) Avail: NTIS HC $4.00 CSCL 10A

A special analytical solution is provided for the timewise response of the circulating fluid temperatures when a sudden step change of the input solar radiation is imposed and remains constant thereafter. An example which demonstrates the transient temperatures at the exit section of a single collector with two different flow patterns is presented. This study is used to supplement some numerical solutions to provide a fairly complete coverage for this type of solar collector. Author

N76-28650# Committee on Science and Technology (U. S. House).
SOLAR SATELLITE POWER SYSTEM CONCEPTS
Washington GPO 1976 656 p refs Hearings before Subcomm. on Space Sci. and Applications and the Subcomm. on Energy Res., Development and Demonstration of Comm. on Sci. and Technol., 94th Congr., 2d Sess., No. 67, 20 Feb. 1976
(GPO-71-588) Avail: Subcomm. on Space Sci. and Applications

Project planning and conceptual designs are outlined for an orbiting solar satellite power station which will transmit solar energy in the form of microwaves to earth ground stations where it will be converted to electricity. Topics discussed are: (1) control systems for the station (on the ground and in space), (2) maintenance of the station, (3) materials selection, (4) dynamic structural analysis (mathematical models), (5) various components used in the station (i.e., microwave antennas), (6) research and

development costs, and in-space construction costs for the station, (7) orbital calculations and launch vehicles for the station, and (8) biological effects of microwaves on humans and animals, and the heat effects of microwaves on the earth's atmosphere. Photographs and diagrams of the proposed solar satellite power station and ground stations are shown. J.R.T.

N76-28651*# General Electric Co., Philadelphia, Pa. Space Div.

CONCEPTUAL APPROACH STUDY OF A 200 WATT PER KILOGRAM SOLAR ARRAY Quarterly Report

R. W. Stanhouse, D. Fox, and W. Wilson 15 Jul. 1976 102 p refs Prepared for JPL

(Contracts NAS7-100; JPL-954393)

(NASA-CR-148505; Doc-76SDS4242; QR-2) Avail: NTIS HC $5.50 CSCL 10A

Solar array candidate configurations (flexible rollup, flexible flat-pact, semi-rigid panel, semi-rigid flat-pack) were analyzed with particular attention to the specific power (W/kg) requirement. Two of these configurations (flexible rollup and flexible flat-pack) are capable of delivering specific powers equal to or exceeding the baseline requirement of 200 W/kg. Only the flexible rollup is capable of in-flight retraction and subsequent redeployment. The wrap-around contact photovoltaic cell configuration has been chosen over the conventional cell. The demand for ultra high specific power forces the selection of ultra-thin cells and cover material. Based on density and mass range considerations, it was concluded that 13 micrometers of FEP Teflon is sufficient to protect the cell from a total proton fluency of 2(10 to the 12th power) particles/sq cm over a three-year interplanetary mission. The V-stiffened, lattice boom deployed, flexible substrate rollup array holds the greatest promise of meeting the baseline requirements set for this study. Author

N76-28652*# Western New Mexico Univ., Silver City.

AN INVESTIGATION OF THE ACCEPTANCE OF SOLAR HEATING AND COOLING IN THE HOUSING INDUSTRY IN NEW MEXICO Final Technical Report, 1 Aug. 1975 - 31 Jul. 1976

Craig R. Lundahl, James Calvert Scott, and David M. Dennis 31 Jul. 1976 286 p

(Grant NsG-902)

(NASA-CR-148528) Avail: NTIS HC $9.25 CSCL 10A

A data base of information relating to the acceptability of solar-energy technology in the New Mexican housing industry was developed. Topics examined include: (1) the factors which influence the adoption of solar-energy systems in the New Mexican housing industry; (2) the degree of acceptability of various solar factors among New Mexican consumers, architects, contractors, financiers, energy suppliers, and governmental officials; and (3) the current attitudes toward the acceptability of solar energy factors in the New Mexican housing industry. Author

N76-28653*# Scientific Translation Service, Santa Barbara, Calif.

SOLAR CELLS

Washington NASA Jul. 1976 17 p Transl. into ENGLISH from Neue Zuercher Zeitung (Germany), no. 287, 24 Jun. 1974 p 23-24

(Contract NAS7-100)

(NASA-TT-F-16744) Avail: NTIS HC $3.50 CSCL 10A

Solar cells which directly convert the incident light energy of the sun into electrical current are described. Cost factors are considered. Author

N76-28654# Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.

USE OF MIXTURES AS WORKING FLUIDS IN OCEAN THERMAL ENERGY CONVERSION CYCLE, PHASE 1 Quarterly Progress Report, 1 Aug. - 31 Oct. 1975

K. E. Starling, L. W. Fish, C. Lawson, and D. Yieh 1975 13 p refs

(Contract E(40-1)-4918)

(ORO-4918-6) Avail: NTIS HC $3.50

The third in the following sequence of OTEC (Ocean Thermal Energy Conversion) mixture cycle simulators has been developed: (1) OTEC 1, a simulation of the working fluid mixture thermodynamic cycle and (2) OTEC 2-1, a simulator obtained by upgrading OTEC 1 to include preliminary sizing routines for major equipment units (but ignoring mass transfer effects) and (3) OTEC 3-1, a simulator obtained by upgrading OTEC 2-1 to include preliminary equipment capital cost routines for major equipment units. Preliminary calculations using the OTEC 3-1 simulator have indicated that for plants having equal power output, mixture OTEC cycles have lower capital cost than pure fluid (propane) OTEC cycles. ERA

N76-28655# California Univ., Berkeley. Lawrence Berkeley Lab.

PHOTOSYNTHESIS AS A RESOURCE FOR ENERGY AND MATERIALS

M. Calvin Aug. 1975 64 p refs Presented at the 8th Intern. Photochemical Congr., Edmonton, Canada, 9 Aug. 1975

(Contract W-7405-eng-48)

(LBL-4239; Conf-750862-1; Conf-751045-1; Conf-751046-1) Avail: NTIS HC $6.25

Photosynthesis, both natural and as a model process, is examined as a possible annually renewable resource for both material and energy. The conversion of carbohydrate from cane, beets, and other sources through fermentation alcohol to hydrocarbon may again become economic in the light of improved fermentation technology. It may also be possible to produce material by direct fermentation of relatively labile carbohydrates in seaweed. Even the direct photosynthetic production of hydrocarbon from known sources (Hevea, etc.), or newly bred ones, seems possible in view of the large number of species and the new techniques of plant cell cloning which have already been successful on sugar cane. Finally, more distantly, synthetic systems constructed on the basis of our growing knowledge of the photosynthetic processes may produce fuel fertilizer and power. Author (ERA)

N76-28656# Spectrolab, Inc., Sylmar, Calif.

PRELIMINARY EVALUATION OF TWO-ELEMENT OPTICAL CONCENTRATORS FOR USE IN SOLAR PHOTOVOLTAIC SYSTEMS

30 Jun. 1975 64 p

(Contract W-31-109-eng-38)

(ANL-K-75-3191-1) Avail: NTIS HC $4.50

The use of the compound parabolic concentrator design as a field collector - in conjunction with a primary focusing concentrator, is evaluated. The primary focusing concentrator may be a parabolic reflector, an array of Fresnel mirrors, a Fresnel lens, or some other type. Several candidate configurations of such compound systems (focusing concentrators/CPC field collectors) are considered. An analytic evaluation of the technical performance of these systems is performed and the most promising configurations pertinent to coupling CPC concentrators to solar cells are identified. ERA

N76-28657# Bechtel Corp., Los Angeles, Calif.

TECHNICAL AND ECONOMIC ASSESSMENT OF THE PROSPECTS FOR ELECTRICAL POWER GENERATION BY USE OF SOLAR PONDS

Aug. 1975 54 p refs

(TID-26888) Avail: NTIS HC $5.50

The general technical and economic feasibility of using non-converting solar ponds as a means of generating electric power is assessed. A review of the literature and the BNW report showed that information on the engineering design and cost of such a power plant was fragmentary. To form a basis for this study, a baseline design was conceptualized relying partially on claims published in the literature. ERA

N76-28658# Brookhaven National Lab., Upton, N.Y.

IMPACT ANALYSIS FOR ENTHALPY MANAGEMENT IN BUILDING SYSTEMS

C. Braun 25 Sep. 1975 19 p refs Sponsored by ERDA

(BNL-20524) Avail: NTIS HC $4.50

The potential impacts of four methods for reducing fuel consumption in the space heating of buildings are calculated. The results in terms of fuel oil and dollars saved are summarized. The fuel conservation methods include: improving the efficiency of oil fueled space heating equipment; thermal insulation and improved dynamic operation of both new and existing masonry buildings; and the utilization of off peak electric power in

conjunction with thermal storage devices for space heating. (LCL) Author (ERA)

N76-28659# GTE Labs., Inc., Waltham, Mass.
SEALED LITHIUM INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Jun. - 31 Aug. 1975
N. Marincic and A. Lombardi Dec. 1975 28 p refs
(Contract DAAB07-74-C-0108; DA Proj. 1S7-62705-AH-94)
(AD-A019215; ECOM-74-0108-6; QR-6) Avail: NTIS CSCL 10/3

Work has continued using the standard size D cell as a test vehicle to improve the hermetic cell design with regard to venting and fusing. Passivation studies were also undertaken using three different approaches. Partially discharging the cells before storage gave mixed results, casting doubt on this method for improving the delay. Etching the anodes prior to assembly and cathode pretreatment also proved inadequate for improving the voltage delay. Author (GRA)

N76-28660# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME RESULTS OF THE INVESTIGATION OF MHD GENERATORS WITH NON-EQUILIBRIUM CONDUCTIVITY
V. S. Golubev and V. A. Gurashvili 2 Jan. 1976 22 p refs Transl. into ENGLISH from 6th Intern. Conf. on Magnetohydrodynamic Electrical Power Generation, Washington, D. C. (USSR), v. 5, Jun. 1975 p 73-85, 9-13
(AD-A019705; FTD-ID(RS)I-2490-75) Avail: NTIS CSCL 10/2

The authors investigated MHD generators with non-equilibrium conductivity, and also the physical properties of non-equilibrium plasmas typical for such generators. The results make it possible to conduct reliable calculations of the MHD generators. GRA

N76-28661# Interagency Task Force on Synthetic Fuels, Washington, D. C.
RECOMMENDATIONS FOR A SYNTHETIC FUELS COMMERCIALIZATION PROGRAM. VOLUME 1: OVERVIEW REPORT
Nov. 1975 215 p refs Sponsored by ERDA and Energy Resources Council.
(PB-249445/8; FEA/B-76/046-Vol-1) Avail: NTIS HC $5.50; HC also available in set of 4 reports as PB-249444-SET, HC $60.00 CSCL 10A

An interagency Task Force was formed to examine alternatives for assuring early commercialization of synthetic fuels in the United States. The results of the Task Force's efforts are summarized in this overview. The analyses included consideration of: the economic and environmental costs and benefits associated with alternative programs for accelerating synthetic fuels commercialization; alternative incentives which might be offered by the Federal Government including their effectiveness and cost; and measures needed for expeditious implementation of a program assuming a decision is made to proceed. GRA

N76-28662# Interagency Task Force on Synthetic Fuels, Washington, D. C.
RECOMMENDATIONS FOR A SYNTHETIC FUELS COMMERCIALIZATION PROGRAM. VOLUME 2: COST/BENEFIT ANALYSIS OF ALTERNATE PRODUCTION LEVELS
Nov. 1975 362 p refs Sponsored by ERDA and the Energy Resources Council
(PB-249446/6; FEA/B-76/047-Vol-2) Avail: NTIS HC $10.50; HC also available in set of 4 reports as PB-249444-SET, HC $60.00 CSCL 10A

This report examines alternatives for implementing the President's goal of assuring early commercialization of synthetic fuels in the United States. The cost/benefit analysis addressed the question of whether the Federal Government should accelerate the commercial production of synthetic fuels and, if so, at what rate. Specifically, the alternative program levels evaluated in this report are: (1) No Program - no Federal involvement in a commercialization program, but continuation of research and development and normal investment decisions by U.S. industry. (2) Information Program - Federal involvement designed to assist in the establishment of the equivalent of 350,000 barrels per day in capacity. (3) Medium Program - designed to produce approximately 1,000,000 barrels per day. (4) Maximum Program - designed to produce approximately 1,700,000 barrels per day. GRA

N76-28663# Interagency Task Force on Synthetic Fuels, Washington, D. C.
RECOMMENDATIONS FOR A SYNTHETIC FUELS COMMERCIALIZATION PROGRAM. VOLUME 3: TECHNOLOGY AND RECOMMENDED INCENTIVES
Nov. 1975 982 p refs Sponsored by ERDA and the Energy Resources Council
(PB-249447/4; FEA/B-76/048-Vol-3) Avail: NTIS HC $23.75; HC also available in set of 4 reports as PB-249444-SET, HC $60.00 CSCL 10A

This report presents the technology and incentives recommended to establish a commercially viable Synthetic Fuels Commercialization Program (SCP) directed toward achieving the President's goal of one million barrels of crude oil equivalent per day in 1985. Analysis of each incentive considers its ability to meet the following criteria: effectiveness, competitiveness, administrative feasibility, federal involvement, flexibility, breadth of participation, existing authority, and contingency analyses. Availability of energy producing raw materials such as coal, shale, and biomass waste and the market for synthetic fuels is covered. Portions of this report are not fully legible. GRA

N76-28664# Interagency Task Force on Synthetic Fuels, Washington, D. C.
RECOMMENDATIONS FOR A SYNTHETIC FUELS COMMERCIALIZATION PROGRAM. VOLUME 4: DRAFT ENVIRONMENTAL IMPACT STATEMENT
Dec. 1975 986 p refs Sponsored by ERDA and the Energy Resources Council
(PB-249448/2; FEA/B-76/049-Vol-4) Avail: NTIS HC $23.75; HC also available in set of 4 reports as PB-249444-SET, HC $60.00 CSCL 10A

The President announced a Synthetic Fuels Commercialization Program to accelerate the production of synthetic fuels from coal, oil shale and solid wastes. This Draft Environmental Impact Statement presents a generic assessment of the potential environmental impacts associated with the undertaking of this Program. GRA

N76-28665# Nottingham (H. D.) and Associates, Inc., McLean, Va.
REVIEW AND ANALYSIS OF NATIONAL ENERGY RESEARCH AND DEVELOPMENT PROGRAMS AND PROPOSALS Final Report
T. Singh and J. S. Soni Jan. 1976 437 p
(Contract DAAG53-75-C-0233)
(AD-A020794; USAFESA-RT-2006) Avail: NTIS CSCL 10/1

Tabulated and analyzed in this report are recently completed and on-going energy R and D programs by pertinent governmental and industrial organizations. The five major areas of discussion in this study include: nuclear fission; renewable energy resources; conversion systems; energy conservation; and multi-directional energy R and D studies. Outlined are the state-of-the-art; established national goals and objectives; nature of R and D studies currently underway; and recommendations for future R and D work by the U.S. Army. GRA

N76-28666# Army Facilities Engineering Support Agency, Fort Belvoir, Va. Research and Technology Div.
ENERGY CONSERVATION OUTLINE Interim Report
Casimir A. Kukielka 1 Dec. 1975 19 p refs
(AD-A020139; RT-2007) Avail: NTIS CSCL 10/1

A compilation of energy conservation ideas and concepts obtained from a review of manuals, guidelines, reports, letters and memos from several government agencies and private industry is presented. The outline is broken down into major categories where these energy conservation techniques may lead to reduced energy consumption. Examples are used for clarity, to show possible savings and to stimulate new conservation concepts and ideas. GRA

N76-28667# Dubin-Mindell-Bloome Associates, New York.
GUIDELINES FOR SAVING ENERGY IN EXISTING BUILD-

INGS. ENGINEERS, ARCHITECTS, AND OPERATORS MANUAL, ECM 2
Fred S. Dubin, Harold L. Mindell, and Selwyn Bloome 16 Jun. 1975 434 p refs
(Contract DI-14-01-0001-1844)
(PB-249929/1; FEA/D-75/358; FEA/D-CP-21) Avail: NTIS HC $11.75 CSCL 13A

Energy conservation measures which can result in further energy savings of 15 to 20% with an investment cost that can be recovered within 10 years through lower operating expenses are discussed. GRA

N76-28668# Dubin-Mindell-Bloome Associates, New York.
GUIDELINES FOR SAVING ENERGY IN EXISTING BUILDINGS. BUILDING OWNERS AND OPERATORS MANUAL, ECM 1
Fred S. Dubin, Harold L. Mindell, and Selwyn Bloome 16 Jun. 1975 282 p refs
(Contract DI-14-01-0001-1844)
(PB-249928/3; FEA/D-75/359; FEA/D-CP-20) Avail: NTIS HC $9.25 CSCL 13A

National energy usage in existing commercial buildings, methods of reducing energy consumption through conservation, and the resulting costs and benefits are examined. A wide range of opportunities and options to save energy and operating costs through proper operation and maintenance are discussed. Minor modifications to the building and mechanical and electrical systems which can be implemented promptly with little if any investment costs are included. GRA

N76-28669# Mathematica, Inc., Princeton, N.J.
COMPREHENSIVE EVALUATION OF ENERGY CONSERVATION MEASURES Final Report
Dilip R. Limaye, John R. Sharko, Jeffrey P. Price, and Joseph A. Orlando Mar. 1976 449 p refs
(Contract EPA-68-01-2440; EPA-68-01-2445)
(PB-250824/0; EPA-230/1-75-003) Avail: NTIS HC $11.75 CSCL 13A

An analysis of the relative social, economic, and environmental impacts and energy savings associated with thirty proposed energy conservation measures is presented. Residential, commercial, industrial, power generation and transportation energy consumption are covered. Projections are national for the years 1977, 1980, 1985, and 1990. A ranking of measures compares the relative costs and effectiveness of measures. The methodology can be adapted to a variety of situations. GRA

N76-28670# Mathematica, Inc., Princeton, N.J.
COMPREHENSIVE EVALUATION OF ENERGY CONSERVATION MEASURES, APPENDICES Final Report
Dilip R. Limaye, John R. Sharko, Jeffrey P. Price, and Joseph A. Orlando Mar. 1975 143 p refs
(Contracts EPA-68-01-2440; EPA-68-01-2445)
(PB-250825/7; EPA-230/1-75-004) Avail: NTIS HC $6.00 CSCL 13A

Appendices provide detailed methodology, data base and technical discussions in the areas of energy consumption, space heating, hot water heating, heat pumps, and total energy systems. GRA

N76-28671# Federal Energy Administration, Washington, D.C.
PETROLEUM MARKET SHARES. HISTORICAL REPORT ON REFINERS AND IMPORTERS OF MOTOR GASOLINE, 1972 THROUGH 1974
Oct. 1975 80 p
(PB-249081/1; FEA/B-75/616) Avail: NTIS HC $5.00 CSCL 21D

The Federal Energy Administration (FEA) conducted a survey of refiners and importers of refined petroleum products for the period from January 1972 through December 1974. The survey collected historical information on the marketing of motor gasoline, other distillates, and residual fuel oils. This report covers the distribution of motor gasoline by refiners at the first point of sale into the marketing stream. GRA

N76-28672# RMC Research Corp., Bethesda, Md.
INTERCITY PASSENGER TRANSPORTATION: MODE/ENERGY CONSERVATION. VOLUME 2: ANALYSIS Final Report
George Roche and Armando M. Lago Dec. 1975 325 p refs
(Contract EQ4AC028)
(PB-250884/4; RMC-UR-286-Vol-2; EQ-5174130282-Vol-2)
Avail: NTIS CSCL 10A

Contents: Intercity passenger data; Development of intercity passenger demand models; Energy conservation policies and their impacts; Evaluation of alternative energy conservation policies; Analyses of regression results; Travel and energy data for conservation policies; Regression analyses using air/auto costs. Portions of this document are not fully legible. Author (GRA)

N76-28276* Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHAPE OPTIMIZATION OF DISC-TYPE FLYWHEELS
Richard S. Nizza *In* JPL 10th Aerospace Mech. Symp. 1 Jul. 1976 p 38-51 refs (For availability see N76-28272 19-18) CSCL 10C

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-28673 California Inst. of Tech., Pasadena.
TURBULENT CHEMICAL REACTIONS: APPLICATION TO ATMOSPHERIC CHEMISTRY Ph.D. Thesis
Wiston Rei-Yun Shu 1976 201 p
Avail: Univ. Microfilms Order No. 76-16378

The general problem of predicting the rates of chemical reactions in turbulent fluid was studied. Particular attention was given to bimolecular (second-order) chemical reactions occurring isothermally. The problem of predicting the rates of turbulent chemical reactions was formulated in both Eulerian and Lagrangian frameworks. The Eulerian formulation leads to a closure problem in the equations for the moments of concentrations of the reacting species. The Lagrangian formulation, while circumventing the usual closure problem, is based on a transition probability density function of particle displacements which can only be predicted in the simplest of cases. Dissert. Abstr.

N76-28674 Oklahoma Univ., Norman.
OVERLAND FLOW TREATMENT OF PACKINGHOUSE WASTEWATER Ph.D. Thesis
M. L. Rowe 1976 110 p
Avail: Univ. Microfilms Order No. 76-16309

Overland flow irrigation was used for the treatment of dairy, paper mill, and cannery wastes but few overland flow systems were designed for the treatment of waste from the red meat industry. This research project was designed to evaluate overland flow irrigation as a treatment system suitable for small meat processing operations. The treatment system involved the use of three 0.1 acre Bermuda grass plots. Untreated wastewater from the meat processing plant was subjected to mechanical screening for solids removal and then applied to the Bermuda grass plots. The removal efficiencies for several pollutants were examined in relation to various hydraulic loadings and climatic conditions. The results that the treatment system could meet the 1977 discharge limits for all parameters except fecal coliform bacteria. The 1983 maximum daily limits for BOD and suspended solids were sometimes exceeded when rainfalls greater than 0.7 inches per day occurred. Dissert. Abstr.

N76-28675 Kansas Univ., Lawrence.
FUNDAMENTAL STUDIES OF THE NITRIFICATION PROCESS Ph.D. Thesis
Mary Frances McGhee 1975 131 p
Avail: Univ. Microfilms Order No. 76-16754

The effects of pH, carbon concentration, ammonia and nitrite concentration, certain trace metals, and sludge retention time on the nitrification process were studied. The nitrification energy-synthesis relationships were also investigated. Two complete mixing activated sludge laboratory units, acclimated to a feed concentration of 100 mg/l of ammonia-nitrogen, served as the source of nitrifying bacteria for the studies. Warburg respirometer oxygen uptake runs were used primarily for the basic metabolic relationships. The study confirmed the importance

of pH for the nitrifying bacteria; but the pH was controlled by the available bicarbonate concentration. Ammonia oxidation required sufficient bicarbonates for complete neutralization of the acids formed. The basic synthesis reaction resulted in 93.4% oxidation of ammonia-nitrogen and 98.6% oxidation of nitrite-nitrogen with the remaining nitrogen converted to cellular protoplasm. The low energy yields required maintenance of long solids retention times to keep a viable microbial population in the system. Dissert. Abstr.

N76-28676 Minnesota Univ., Minneapolis.
VEHICULAR AIR POLLUTION AS AFFECTED BY RESIDENTIAL SETTLEMENT AND TRAVEL BEHAVIOR PATTERNS IN THE TWIN CITIES METROPOLITAN AREA Ph.D. Thesis
Raymond Walter Thron 1975 213 p
Avail: Univ. Microfilms Order No. 76-14971

Vehicular air pollutant emissions were calculated using data obtained from a regional travel behavior inventory. The travel behavior inventory, which was accomplished in 1970 under the direct supervision of the Metropolitan Council, included base data information on person trips and household characteristics within the seven county Twin Cities Metropolitan Area. The methodology for determining vehicular air pollutant emissions, as established by the U. S. Environmental Protection Agency, was modified to incorporate data from the travel behavior inventory. The vehicular air pollutant emission computations were accomplished at a district and zonal level over the entire Twin Cities Metropolitan Area. The district level emission computations included heavy-duty and diesel powered vehicles as well as light-duty gasoline powered vehicles. The zonal level computations were made for light-duty vehicles only. Dissert. Abstr.

N76-28677 California Univ., Berkeley.
PLANNING FOR SOLID WASTES MANAGEMENT: POST-COLLECTION ALTERNATIVES Ph.D. Thesis
Edwin Charles Kampmann 1975 589 p
Avail: Univ. Microfilms Order No. 76-15250

Effects of alternative physical operations for dealing with solid wastes are described and compared according to a comprehensive set of objectives for public policies for a metropolitan urban region. Data for Alameda and Contra Costa Counties, California were used to provide a realistic example for calculations. Investigation is restricted to dealing with wastes only after they have been placed in a collector-truck vehicle. Social objectives considered included standard waste management concerns in finance and in environmental quality. They also included concerns regarding urban land use, social equity and regional distribution of benefits, and the political and administrative organization for wastes management. Each different kind of waste handling operation was considered not only in light of the objectives it is most helpful in achieving, but also in terms of its contributions towards meeting other system objectives as a part of a solid wastes post-collection management system. Dissert. Abstr.

N76-28678# California Univ., Berkeley.
FOAM AND BUBBLE FRACTIONATION Ph.D. Thesis
Ernesto ValdesKrieg 1975 451 p
Avail: Univ. Microfilms Order No. 76-15401

Processes were studied and tested that utilize adsorption on bubble-liquid interfaces (absorptive bubble separation processes) to remove small amounts of pollutants from water. Typical pollutants removed included surface active agents, heavy metal cations and particulate matter from solutions of various compositions. Basic studies were conducted to determine surfactant absorption equilibria at gas-liquid interfaces utilizing a tall, narrow bubble column in which solution and finely dispersed air flowed in concurrent flow. The technique allowed direct measurement of surface equilibria and estimation of mass transfer rates for the adsorption process utilizing the well-known dispersion model to estimate Peclet numbers and mass transfer coefficients from bulk-liquid axial concentration profiles in the column. Mass transfer rate results suggest adsorption equilibration kinetics at interfaces as the rate limiting mechanisms, as compared to diffusion through the bulk-liquid surrounding the air liquid interfaces. Dissert. Abstr.

N76-28679*# Battelle Columbus Labs., Ohio.
AN ANALYSIS OF THE MARKET POTENTIAL OF WATER HYACINTH-BASED SYSTEMS FOR MUNICIPAL WASTEWATER TREATMENT Final Report
A. C. Robinson, H. J. Gorman, M. Hillman, W. T. Lawhon, D. L. Maase, and T. A. McClure 31 Jan. 1976 250 p refs
(Contract NASw-2800)
(NASA-CR-148469; BCL-OA-TFR-76-5) Avail: NTIS HC $8.00 CSCL 13B

The potential U.S. market for tertiary municipal wastewater treatment facilities which make use of water hyacinths was investigated. A baseline design was developed which approximates the 'typical' or 'average' situation under which hyacinth-based systems can be used. The total market size for tertiary treatment was then estimated for those geographical regions in which hyacinths appear to be applicable. Market penetration of the baseline hyacinth system when competing with conventional chemical and physical processing systems was approximated, based primarily on cost differences. A limited analysis was made of the sensitivity of market penetration to individual changes in these assumptions. Author

N76-28680*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF SIX BROADBAND OPTICAL FILTERS FOR MEASURING CHLOROPHYLL ALPHA AND SUSPENDED SOLIDS IN THE PATUXENT RIVER
Craig W. Ohlhorst Washington, NASA Jul. 1976 51 p refs
(NASA-TM-X-3399; L-10769) Avail: NTIS HC $4.50 CSCL 13B

Kodak Wratten broadband optical filters numbered 47B (400 to 500 nm), 57 (500 to 600 nm), 58 (500 to 600 nm), 12 (500 to 700 nm), 25 (600 to 700 nm), and 89B (690 to 900 nm) were tested on October 17, 1972, to see whether each spectral band by itself could be used to quantify chlorophyll a and suspended sediment in the Patuxent River. Band 690 to 900 nm showed promise in being able to detect gross changes in chlorophyll a above 28 micrograms/l. None of the broad spectral bands seem capable of measuring chlorophyll a concentrations less than 28 micrograms/l in turbid estuarine water. Except for the 47B spectral band, the bands do show promise for measuring suspended solids. Author

N76-28681# Council on Environmental Quality, Washington, D.C.
FLUOROCARBONS AND THE ENVIRONMENT: REPORT OF FEDERAL TASK FORCE ON INADVERTENT MODIFICATION OF STRATOSPHERE (IMOS)
Jun. 1975 113 p refs
(LC-75-600057) Avail: NTIS MF $2.25; SOD HC $1.90

The potential effects of fluorocarbons on the ozone concentration of the stratosphere were studied. It was concluded that fluorocarbons released to the environment are a legitimate cause for concern. It was also concluded that unless new scientific evidence is found to remove the cause for concern, it would seem necessary to restrict uses of fluorocarbons-11 and -12 to replacement of fluids in existing refrigeration and air conditioning equipment and to closed recycled systems or other uses not involving release to the atmosphere. Other conclusions and recommendations relate to the expected effects of any reduction in the average ozone concentration in the stratosphere: the need for labeling aerosol products containing fluorocarbons; the present Federal authorities under which various regulatory actions could be initiated; the need for toxic substances control legislation; the need for international cooperation; and the Federal research program for addressing the scientific and socio-economic issues. Author

N76-28682*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NUMERICAL MODELING OF POLLUTANT TRANSPORT USING A LAGRANGIAN MARKER PARTICLE TECHNIQUE
Malcom Spaulding (Rhode Island Univ.) Aug. 1976 35 p refs
(NASA-TM-X-73930) Avail: NTIS HC $4.00 CSCL 13B

A derivation and code were developed for the three-dimensional mass transport equation, using a particle-in-cell solution technique, to solve coastal zone waste discharge problems

where particles are a major component of the waste. Improvements in the particle movement techniques are suggested and typical examples illustrated. Preliminary model comparisons with analytic solutions for an instantaneous point release in a uniform flow show good results in resolving the waste motion. The findings to date indicate that this computational model will provide a useful technique to study the motion of sediment, dredged spoils, and other particulate waste commonly deposited in coastal waters. Author

N76-28683*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONCENTRATIONS OF TRACE ELEMENTS AND COMPOUNDS IN THE AIRBORNE SUSPENDED PARTICULATE MATTER IN CLEVELAND, OHIO, FROM AUGUST 1971 TO AUGUST 1972 AND THEIR DEPENDENCE ON WIND DIRECTION: COMPLETE DATA LISTING AND CONCENTRATION ROSES
Robert B. King and Harold E. Neustadter Jun. 1976 192 p
(NASA-TM-X-73453; E-8795) Avail: NTIS HC $7.50 CSCL 13B

Concentrations of 75 chemical constituents in the airborne particulate matter were measured in Cleveland, Ohio during 1971 and 1972. Daily values, maxima, geometric means and their standard deviations covering a 1-year period (45 to 50 sampling days) at each of 16 sites are presented on microfiche for 60 elements, and for a lesser number of days for 10 polycyclic aromatic hydrocarbon compounds (PAH), the aliphatic hydrocarbon compounds (AH) as a group and carbon. In addition, concentration roses showing directional properties are presented for 39 elements, 10 PAH and the AH as a group. The elements (except carbon) are shown both in terms of concentration and percentage of the suspended particulate matter. Author

N76-28684# Toups Corp., Santa Ana, Calif.
WATER POLLUTION ABATEMENT TECHNOLOGY. CAPABILITIES AND COSTS, IRRIGATED AGRICULTURE Final Report
Mar. 1976 272 p refs
(Contract WQ5AC087)
(PB-250016/3; NCWQ-75/37) Avail: NTIS HC $9.00 CSCL 02B

Pollution control options are examined for each of nine geographic regions, comprising 96% of the nation's irrigated agriculture. Both structural and nonstructural controls are considered for three alternative levels of control, with different controls applicable depending upon whether the land is drained or undrained. Aggregated cost estimates (in 1973 dollars) range from $296 million to $4,450 million depending upon the treatment level selected, with corresponding annual costs of $143 million to $491 million. Costs and effectiveness of control measures will vary widely depending on existing irrigation practices. GRA

N76-28685# Operations Research, Inc., Silver Spring, Md.
CLIMATIC IMPACT ASSESSMENT PROGRAM, DEVELOPMENT AND ACCOMPLISHMENTS 1971 - 1975
J. Mormino, D. Sola, and C. Patten Dec. 1975 196 p refs
(Contract DOT-OS-20183)
(PB-250641/8; DOT-TST-76-41) Avail: NTIS HC $7.50 CSCL 04A

The history of the Climatic Impact Assessment Program (CIAP) is traced from the time of the debate on the U.S. Supersonic Transport (SST) through the publication of the six CIAP Monographs in September 1975. It highlights important dates, scientific accomplishments, and major contributing organizations. GRA

N76-28686# Exxon Research and Engineering Co., Linden, N.J.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSES. GASIFICATION: SECTION 8. WINKLER PROCESS Final Report
C. E. Jahnig Sep. 1975 51 p refs
(Contract EPA-68-02-0629)
(PB-249846/7; EXXON/GRU.14DG.75; EPA-650/2-74-009-J) Avail: NTIS HC $4.50 CSCL 07A

Results are given of a review of the Winkler coal gasification process, from the standpoint of its potential for affecting the environment. The quantities of solid, liquid and gaseous effluents have been estimated where possible, as well as the thermal efficiency of the process. For the purpose of reduced environmental impact, control systems, modifications, and alternatives which could facilitate pollution control or increase thermal efficiency are discussed, and new technology needs are pointed out. GRA

N76-28687# Exxon Research and Engineering Co., Linden, N.J.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSES. ANALYTICAL TEST PLAN Final Task Report
C. D. Kalfadelis, E. M. Magee, G. E. Milliman, and T. D. Searl Oct. 1975 186 p refs
(Contract EPA-68-02-0629)
(PB-249845/9; EXXON/GRU.13DG.75; EPA-650/2-74-009-I) Avail: NTIS HC $7.50 CSCL 07A

The report gives results of a preliminary definition of those streams which require analysis to permit an assessment of the pollution potential of the processes in the light of current environmental standards, using a coal gasification process (Lurgi) and a coal liquefaction process (COED) as a basis. It defines methods for sampling indicated streams and analytical procedures which are required to obtain the data. These summaries may be readily modified or adapted to other processes, and expanded to include additional polluting constituents or improvements in analytical procedures. The report also contains the industrial set up of the processes for gasification and liquefaction of coal. GRA

N76-28688# Exxon Research and Engineering Co., Linden, N.J.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSES. LIQUEFACTION: SECTION 3. H-COAL PROCESS Final Task Report
C. E. Jahnig Oct. 1975 69 p refs
(Contract EPA-68-02-0629)
(PB-249847/5; EXXON/GRU.15DJ.75; EPA-650/2-74-009-M) Avail: NTIS HC $4.50 CSCL 07A

Results are given of a review of the H-Coal Process of Hydrocarbon Research, Inc., from the standpoint of its effect on the environment. Quantities of solid, liquid, and gaseous effluents are specified, where possible, as well as the thermal efficiency of the process. Techniques for controlling pollution are outlined and discussed. For the purpose of reducing environmental impact, a number of possible modifications or alternatives are presented for consideration. In some areas existing information or control systems are inadequate; therefore, technology needs are pointed out covering such areas, together with approaches to improve efficiency and conservation of energy or water. GRA

N76-28689# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
NOx ABATEMENT FOR STATIONARY SOURCES IN JAPAN Final Report, Jul. 1974 - Mar. 1975
Jumpei Ando (Chuo Univ., Tokyo, Japan), Heiichiro Tohata (Chuo Univ., Tokyo, Japan), and Gerald A. Isaacs Jan. 1976 116 p refs
(Contract EPA-68-02-1321)
(PB-250586/5; EPA-600/2-76-013-B) Avail: NTIS HC $5.50 CSCL 07A

Regulations for NOx abatement in Japan are summarized. Techniques for abatement by means of combustion control are described, and current wet and dry processes for denitrification flue gases are analyzed in detail. Six different low NOx oil burner designs are discussed. Descriptions of the major NOx removal processes are included. The chemistry of NOx liquid reactions is discussed as it applies to the various scrubber processes: advantages and disadvantages of the processes are listed. Author (GRA)

N76-28690# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
SO2 ABATEMENT FOR STATIONARY SOURCES IN JAPAN Final Report, Jul. 1974 - Mar. 1975
Jumpei Ando (Chuo Univ., Tokyo) and Gerald A. Issacs Jan. 1976 195 p refs
(Contract EPA-68-02-1321)
(PB-250585/7; EPA-600/2-76-013-A) Avail: NTIS HC $7.50 CSCL 07A

The status of desulfurization technology in Japan up to January

1975 is described, with emphasis on the recovery of SO2 in lime/limestone based processes. Current status of desulfurization technologies, including hydrodesulfurization of oil, decomposition of residual oil, gasification of coal and oil, and flue gas desulfurization (FGD), is discussed. Major Japanese FGD processes are examined in detail. Technical and economic aspects of the systems are reviewed, and the processes are evaluated for potential U.S. application. Principal by-products of the various systems are discussed. Author (GRA)

N76-28691# Kellogg (M. W.) Co., Houston, Tex.
EVALUATION OF R AND D INVESTMENT ALTERNATIVES FOR SOx AIR POLLUTION CONTROL PROCESSES, PART 2 Final Report, Mar. - Dec. 1974
S. Caceres, L. Do, N. Gonzalez, H. A. Khan, and G. K. Mathur Aug. 1975 270 p refs
(Contract EPA-68-02-1308)
(PB-250724/2; EPA-650/2-74-098-A-Pt-2) Avail: NTIS HC $9.00 CSCL 13B

The report gives results of an extension of work done in Part 1 of the study, reported in September 1974. Of the five major sources of sulfur oxide emissions studied in Part 1, new or enlarged data bases are presented for three: utility plants, industrial boilers, and sulfuric acid plants. Cost models developed for the wet limestone process and the Wellman/Allied process are applied to these source groups, and the results summarized. Application of the Wellman/Allied system to Claus plants is also discussed. Economics are shown for a packaged limestone scrubbing system for small industrial boilers. Cost models, derived from the model for substitute natural gas plants developed in Part 1, are included for low-Btu and intermediate-Btu gas plants. Production costs of substitute natural gas, low-Btu gas, and solvent refined coal are presented, based on actual coal prices in the U.S. GRA

N76-28692# Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div.
MEASUREMENT OF TOTAL RADIUM AND RADIUM 226 IN ENVIRONMENTAL WATERS: A TENTATIVE REFERENCE METHOD
Mar. 1976 37 p refs
(PB-251313/3; EPA-600/4-76-012) Avail: NTIS HC $4.00 CSCL 18H

A tentative reference method for the measurement of total radium and radium-226 in environmental water sources is described. Samples are collected, preserved with acid-barium carrier treatment, and analyzed for total radium and/or radium-226. For samples analyzed for total radium, the radium is separated from the sample with barium and lead carriers. The barium and radium are then separated from the lead carrier, precipitated as the sulfate, filtered, and counted for alpha activity. For samples analyzed for radium-226, the radium is separated from the sample with barium carrier, dissolved and transferred to a de-emanation bubbler, the radon-222 daughter allowed to grow in, the ingrown radon-222 de-emanated from the solution and transferred to a scintillation counting cell, and alpha counted. GRA

N76-28693# Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div.
MEASUREMENT OF STRONTIUM-89 AND STRONTIUM-90 IN ENVIRONMENTAL WATERS: A TENTATIVE REFERENCE METHOD
Mar. 1976 26 p ref
(PB-251312/5; EPA-600/4-76-011) Avail: NTIS HC $4.00 CSCL 18H

A tentative reference method for the measurement of strontium-89 and -90 in environmental waters is described. Samples of environmental water sources are collected, preserved with acid-strontium carrier, and analyzed for strontium-89 and/or strontium-90. Strontium-89 and -90 are separated from the sample water by precipitating with stable strontium carrier as carbonate. The strontium carbonate is dissolved, yttrium-90 separated, the strontium reprecipitated as carbonate, filtered, and counted for the combined strontium-89 and -90 activity. The yttrium-90 is allowed to grow in from the strontium-90 activity; the strontium carbonate is redissolved; the yttrium-90 is separated, precipitated, and counted for the strontium-90 determination. The strontium-89 activity is then determined by difference of the total strontium-89 and -90 and the separate strontium-90 activities. GRA

N76-28694# Environmental Protection Agency, Washington, D.C. Div. of Water Planning.
RESIDUAL WASTE MANAGEMENT RESEARCH AND PLANNING PROJECT
Sep. 1975 326 p
(PB-250954/5; EPA-440/9-76-003) Avail: NTIS HC $10.00 CSCL 13B

This book contains selected abstracts of projects that are underway or that have been completed and publications that are available on the subject of residual wastes and their impact of ground and surface waters. They are arranged by types of residual wastes and are further categorized into the various kinds. The abstracts are cross-referenced where necessary. The abstracts provide project or publication identification, a brief summary, the status of the project, point of contact and/or source of information, and acquisition details. GRA

N76-28695# Stanford Research Inst., Menlo Park, Calif.
THE ENVIRONMENTAL FATE OF SELECTED POLYNUCLEAR AROMATIC HYDROCARBONS Final Report
S. B. Radding, T. Mill, C. W. Gould, D. H. Liu, H. L. Johnson, D. C. Bomberger, and C. V. Fojo Feb. 1976 131 p refs
(Contract EPA-68-01-2681)
(PB-250948/7; EPA-560/5-75-009) Avail: NTIS HC $6.00 CSCL 13B

A review of the recent literature on polynuclear (polycyclic) aromatic hydrocarbons (PAH) has been carried out for general information on PAH and specific details about six selected PAH. The sources, transport, chemical and physical transformations, structure-reactivity relationships, and biological (non-carcinogenic) properties have been reviewed with recommendations for further research. GRA

N76-28696# Engineering-Science, Inc., McLean, Va.
DEMONSTRATION OF A PLANNING PERSPECTIVE FOR WASTE WATER SLUDGE DISPOSITION, KNOXVILLE/KNOX COUNTY.
Dean Neptune, Michael Wyatt, and Richard Heil Nov. 1975 191 p refs
(Contracts EPA-68-01-3225; EPA Proj. WA-75-R210)
(PB-250936/2; EPA-440/9-76-001-A) Avail: NTIS HC $7.50 CSCL 13B

The existing and future sludge disposal problem in Knoxville, Tenn. was investigated, and six major sludge management plans were developed. The plans were derived and evaluated by using a methodology previously developed by the EPA. The plans detail the processing, transportation, and ultimate disposal sub-systems necessary to meet environmental, operational, and institutional constraints found in the study area. In addition, costs of the various sub-systems and the overall costs of the plans were determined. GRA

N76-28697# Kansas Water Resources Research Inst., Manhattan.
INTERACTIONS OF MERCURY WITH AQUATIC AND EDAPHIC ENVIRONMENTS Completion Report
David W. Newton, Roscoe Ellis, Jr., and Gary M. Paulsen 1973 73 p refs
(Contract DI-14-31-0001-3591)
(PB-251069/1; Contrib-136; WRT-B-027-KAN(2); W76-05601) Avail: NTIS HC $4.50 CSCL 13B

Reactions of Hg with bentonite clay were studied to determine behavior of the metal in aquatic ecosystems. Mercury (II) adsorption by bentonite as a function of pH and complex formation was investigated using a radio-isotopic technique. Maximum Hg(II) adsorption in 0.01 M Ca(NO3)2 systems occurred in the pH range r.5-5.5. Varying the Ca(NO3)2 concentration only slightly influenced adsorption or the pH of maximum Hg(II) adsorption, especially at low pH's glass and plastic containers differ in their ability to retain Hg(II) in solution. GRA

N76-28698# JRB Associates, La Jolla, Calif.
A METHODOLOGY FOR TREATING LARGE LOCALIZED EMISSIONS OF REACTIVE POLLUTANTS Final Report

A. J. Fabrick, P. I. Nakayame, and E. J. Fredricksen Feb. 1974 136 p refs
(Contract EPA-68-02-1238)
(PB-251066/7; EPA-650/4-74-006) Avail: NTIS HC $6.00 CSCL 13B

The results of a study to develop a numerical model to accurately calculate the trajectories and concentrations of reactive pollutants emitted from localized sources are presented. The numerical model employs the solution of the full three dimensional Navier Stokes equations along with the solution of the species density equation by summing over Lagrangian mass points. The mass points are transported by the mean wind field and moved with a random walk technique that simulates the turbulent diffusion. The effect of chemical reactions are modeled by reweighing the Lagrangian mass points. The equations are solved for regions of space where terrain features or buildings may cause strong distortions in the flow field. Author (GRA)

N76-28699# Environmental Protection Agency, Chicago, Ill.
NON-POINT SOURCE POLLUTION SEMINAR. SECTION 108(A): DEMONSTRATION PROJECTS (POLLUTION CONTROL IN GREAT LAKES) Progress Report, 1972 - 1975
Ralph G. Christensen Dec. 1975 266 p refs
(PB-250970/1; EPA-905/9-75-007) Avail: NTIS HC $9.00 CSCL 13B

The following topics are discussed: (1) the challenge to American agriculture of P.L. 92-500. From a national viewpoint-focus on 'political rulings as they affect NPS programs'; (2) overview of USEPA research and development as it relates to NPS pollution; (3) USEPA involvement in management of section 108(a) projects; (4)conservation farm planning; (5) impact of social attitudes on managing the environment; (6) tillage and simulated rainfall studies; (7) uses of pesticides and fertilizers in the Black Creek Watershed; (8) sediment contributions to the Maumee River; (9) streambank stabilization; and (10) sediment trap for measuring sediment load. GRA

N76-28700# Health Effects Research Lab., Research Triangle Park, N. C. Exposure Assessment Branch.
COMMUNITY HEALTH ENVIRONMENTAL SURVEILLANCE STUDIES (CHESS) AIR POLLUTION MONITORING HANDBOOK: MANUAL METHODS
William F. Barnard Jan. 1976 135 p refs
(PB-251157/4; EPA-600/1-76-011) Avail: NTIS HC $6.00 CSCL 14B

A methods manual handbook for the Community Health Environmental Surveillance Studies program is reported. It covers Total Suspended Particulates (TSP), Total Suspended Nitrates (TSN), Total Suspended Sulfates (TSS), Respirable Suspended Particulate (RSP), sulfur dioxide, and nitrogen dioxide. This manual is to be used as a reference publication. GRA

N76-28701# Battelle Columbus Labs., Ohio.
SURVEY STUDY OF TECHNIQUES TO PREVENT OR REDUCE DISCHARGES OF HAZARDOUS CHEMICALS Final Report, Mar. - Aug. 1975
H. Norman C. Henderson, Seshadri Srinivasan, and Jerry A. Henkener Aug. 1975 84 p
(Contract DOT-CG-23223-A; CG Proj. 4405.1)
(AD-A020173; USCG-D-184-75) Avail: NTIS CSCL 13/2

A program was conducted for the Office of Research and Development, U. S. Coast Guard, to investigate both off-the-shelf and conceptual techniques for preventing or reducing the discharge of hazardous chemicals from an endangered marine vessel or to stop or reduce the discharge from an actual leak. First, approximately 50 methods and/or types of equipment were identified which involved (1) patching or plugging a leak, (2) cargo off-loading, (3) cargo immobilization, or (4) enclosure/containment of the cargo. Next, the compatibility of each of the concepts and equipment with the CHRIS list of hazardous chemicals was determined on a relative basis. This effort was primarily concerned with adverse material behavior in contact with each CHRIS chemical; however, temperature effects, explosive problems, viscosity, and density were also important parameters depending on the particular concept under consideration. The concepts were then evaluated on the basis of their relative chemical compatibility in combination with overall functionality (e.g. usefulness) and the various types of onsite operations to which they applied. Based on this evaluation, a number of concepts (both off-the-shelf and conceptual) were identified as superior with concurrent recommendations for acquisition or development. Author (GRA)

N76-28702# Environmental Protection Agency, Washington, D.C. Div. of Water Planning.
RESIDUAL WASTE: MODEL STATE LEGISLATION
Don MacDonald, James M. Cole, William F. Dwyer, and Dennis A. OLeary Mar. 1976 158 p refs
(PB-251031/1; EPA-440/9-76-004) Avail: NTIS HC $6.75 CSCL 13B

A planner's handbook is reported which identifies and discusses legislative and regulatory provisions, which will permit and control the disposition of residual waste to the land without endangering water quality. The focal point of the handbook is a model statute entitled 'A State Residual Waste Management and Resource Recovery Act'. The suggested legislative model addresses all phases of the disposal of residual wastes in subsurface excavations or on land. GRA

N76-28703# Tetradyne Corp., Richardson, Tex.
FAST CURRENT OIL RESPONSE SYSTEM Final Report
Fred N. Mueller Apr. 1975 80 p
(Contract DOT-CG-40220-A)
(AD-A020171; USCG-D-115-75) Avail: NTIS CSCL 13/2

A relative velocity can be imparted to a floating oil slick by moving an air jet across the surface of the water. If two long booms are arranged in a 'V' shape and moved across an oil slick, the oil will be blown into a concentrated strip which can then be collected with a suitable collector. The collector application in this study used a flow-through trough and a second air boom to skim the oil off the surface and into an oil concentrator. The complete unit was tested by the Univ. of Michigan at speeds up to 7 ft/sec. The 'Vee' air booms did an excellent job of 'herding' the oil with efficiencies ranging from 100% at 1 ft/sec to 80% at 7 ft/sec. The development of the collector did not reach a point where good efficiencies could be obtained above 4 ft/sec. GRA

N76-28704# Scientific Associates, Inc., Santa Monica, Calif.
DEVELOPMENT AND PRELIMINARY DESIGN OF AN EXPERIMENTAL PROTOTYPE FREE VORTEX OIL SKIMMER Final Report, 30 Jun. 1974 - 30 Jun. 1975
Eugene B. Nebeker and Sergio E. Rodriguez 30 Jun. 1975 95 p refs
(Contract DOT-CG-42732-A)
(AD-A020174; USCG-D-152-75) Avail: NTIS CSCL 13/2

Scientific Associates, Inc. has performed a one-year development and preliminary design of an experimental prototype Free Vortex oil skimmer. Results indicate that the development of the Free Vortex oil has produced a skimmer system which possesses almost all of the performance characteristics usually considered desirable in an oil skimmer. The system is particularly applicable to the operating conditions of specific interest to the Coast Guard: oil films 2-inch thick and less, operation while stationary and in currents up to 0.75 knots, and severe Sea State 4 waves. The utility of this concept is not limited to these particular conditions but includes many other situations and operating modes. The Free Vortex oil skimmer designed during this program with a maximum oil recovery rate of 250 to 300 gpm and fitted with a comminutor/macerator to process debris will weigh about 1300 pounds. The largest dimension will be 12 feet when deployed and can be collapsed to 6 feet for transportation. Objectives of the development portion of this program were to develop and improve (1) surface oil capture, (2) vortex generation and vortex-inflow blending, and (3) recovery oil fraction. Results showed that upwell behavior can be easily eliminated, vortex generation was improved by blending the appropriate flow field more smoothly, and oil fraction was unexpectedly good: at a recovery rate of 120 gpm, about 100 percent oil was recovered at 1/4-inch and greater.Author (GRA)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N76-28705 Nevada Univ., Reno.
EARTHQUAKES PROBABILITY MODELS, RECURRENCE CURVES, AFTERSHOCKS, AND CLUSTERS Ph.D. Thesis
William Underwood Savage 1976 145 p
Avail: Univ. Microfilms Order No. 76-16486

From a detailed examination of the axiomatic basis of the Poisson process in the context of observed earthquake magnitude-frequency and occurrence-frequency distributions, specific non-Poisson earthquake behavior patterns are identified and isolated for further study. Emphasis is placed on understanding the process of earthquake occurrence rather than on the determination of accurate mathematical models. The frequency distribution of magnitude was extensively discussed in terms of the linear relationship log N = a-bM. The Poisson basis of the law is reviewed so as to apply proper statistical procedures to evaluate data samples consistently and accurately. Close examination of the cumulative magnitude-frequency plot combined with use of the maximum likelihood estimator of b is the best b-value analysis technique. Dissert. Abstr.

N76-28706 California Univ., Los Angeles.
THE ORIGIN OF SHEETING JOINTS: A HYPOTHESIS Ph.D. Thesis
William Rudolph Holman 1976 86 p
Avail: Univ. Microfilms Order No. 76-15940

Finite-element calculations of the stresses developed beneath infinite simple sinusoidal topography by: (1) longitudinal and transverse tectonic compression, (2) elastic unloading from an initial lithostatic pressure, (3) annual and diurnal temperature variations, and (4) by a near-surface expansion, such as might be expected from extreme surface heating, weathering, or some other cause, show that tension fracture can originate only near the convex crest of a ridge, whereas fracture initiation under compression first occurs beneath the valley. In contrast to both, sheeting develops best on convex topographic forms, but can also form beneath concave ones, and commonly originates on the flanks of domes. Only expansion of rock near the surface with fracture nearly according to the maximum-principal-strain criterion predicts a fracture pattern consistent with the observed distribution of sheeting fractures in relation to topography. Fracture initiation may be due to grain-scale stresses, and its propagation may depend upon expansion due to secondary microcracking accompanying the primary fracture. Dissert. Abstr.

N76-28707 California Univ., Berkeley.
SEISMOMAGNETISM Ph.D. Thesis
Thomas Glen Hildenbrand 1975 166 p
Avail: Univ. Microfilms Order No. 76-15217

Local variations in the geomagnetic field, produced by changes in the stress distribution along faults are studied for various dislocation models. In addition, a detailed study of seismomagnetism is presented for seismic and aseismic events occurring along the San Andreas fault near Hollister. For the calculation of seismomagnetic anomalies, a numerical scheme has been developed for yielding accurate results for magnetic sources with nonhomogeneous distribution of magnetization. Discussions on interpretational methods for stress-induced magnetic anomalies are also included for inferring the location, geometry and time-varying characteristics of the causative stress field. Author

N76-28708 Brown Univ., Providence, R.I.
THE FRACTURE ENERGY OF EARTHQUAKES Ph.D. Thesis
Moujahed I. Husseini 1975 103 p
Avail: Univ. Microfilms Order No. 76-15645

The arrest of a semi-infinite longitudinal shear crack is caused by either the finiteness of available strain energy or an increase in fracture energy along the trajectory of the running crack. Equations are presented which may be used to evaluate the fracture energy; these relationships are statistically acceptable for Southern California faults and the Tonga-Kermadec Arc earthquakes. Calculated fracture energies were found to be in good agreement with other estimates. An equation is also presented which represents the increase in the b value of the frequency-magnitude relationship for aftershocks with the fracture energy of the main shock. Another equation represents the increase with fracture energy of the duration in days over which M sub L > or = 3 events occur. The San Fernando aftershocks form a pattern in which the fresh fractures fall to the outside of the frictional ruptures. This is not true for the western side, where numerous frictional ruptures occur, implying this region is not the western boundary of the fault. Dissert. Abstr.

N76-28709 Texas Univ., Austin.
BOREHOLE STRAINMETERS FOR SEISMOLOGY Ph.D. Thesis
Dale Wayne Evertson 1975 153 p
Avail: Univ. Microfilms Order No. 76-14445

The borehole strainmeters intended to provide seismologists with an improved instrument for measurement of both dynamic and quasi-static strain activity are discussed. The behavior of both ideal strainmeters and the approximate behavior of real strainmeters, is described. It is shown that the boundary is a dominant factor in the instrument response to compressional waves, shear waves, surface waves, atmospheric noise, and strain-steps. The ideal normal strain components, vertical strain, areal strain, and their sum volume strain, are found for the various stimuli, as a function of depth and, for compressional and shear waves also, as a function of emergence angle. An approximate theory for real strainmeter behavior is found by using as a model a circular steel annulus connected to the hole wall. Strain components, on the interior wall of this annulus, are found in terms of stresses distant from the hole. Experimental results from two sites are presented. Dissert. Abstr.

N76-28710 California Univ., Berkeley.
SPECTRAL ANALYSIS OF GRAVITY AND MAGNETIC ANOMALIES Ph.D. Thesis
Lei-Kuang Leu 1975 176 p
Avail: Univ. Microfilms Order No. 76-15282

A method for the interpretation of potential field data on analysis of the spectra of an anomaly and its moments was developed. For two dimensional structures with polygonal cross sections, expressions for the spectra of the anomalies and their moments are derived. These expressions consist of, except for a factor, sums of exponentials, in which the complex exponents are functions of frequency and the coordinates of the locations of the edges of the polygonal cross section. Exponential approximation is utilized for generating a system of linear equations from the sums. The unknown coefficients in the system of equations yield the locations of the edges of the polygonal cross section of the body. The locations of the centroids of the causative bodies can be accurately obtained by taking the ratios of the spectra of the moments of successive orders. Dissert. Abstr.

N76-28711 Brown Engineering Co., Inc., Huntsville, Ala.
NON-LINEAR ACOUSTIC-GRAVITY WAVE PROPAGATION IN THE ATMOSPHERE Ph.D. Thesis
George Fulton Koehler 1975 81 p
Avail: Univ. Microfilms Order No. 76-15652

Weak nonlinear and dispersive effects are considered for long waves propagating horizontally in an infinite, planar, stratified atmosphere. It is shown by a perturbation expansion that the variation of these waves with time and horizontal distance can be described by a function that satisfies the KortewegdeVries Equation. The coefficients of the equation are integrals over the height of the atmosphere of the equilibrium state and the first order perturbation field which is a solution to a second order, linear, ordinary differential equation. When the atmosphere is composed of layers, each having a constant temperature gradient, the differential equation can be transformed to Bessel's Equation. If the temperature gradient is not constant, or if the effects of wind shear are included, the solution must be obtained numerically. Computer programs to obtain solutions to the differential equation and to perform the appropriate integrations for both the constant and non-constant cases were written. Dissert. Abstr.

N76-28712 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ABSORPTION AND PHOTODISSOCIATION IN THE SCHUMANN-RUNGE BANDS OF MOLECULAR OXYGEN IN THE TERRESTRIAL ATMOSPHERE
G. Kockarts 1976 51 p refs Submitted for publication
(Aeronomica-Acta-A-160-1976) Avail: Issuing Activity

The penetration in the terrestrial atmosphere of solar radiation corresponding to the spectral range of the Schumann-Runge bands of molecular oxygen was analyzed between 1750 and 2050. The variation of the absorption cross section with temperature was taken into account and it is shown that average O2 absorption cross sections cannot lead to the computation of the molecular oxygen photodissociation and to permit a simple determination of the photodissociation coefficients of any minor constituent with smoothly varying absorption cross section. Examples are given for O2, H2O, CO2, N2O, HNO3, and H2O2. Numerical approximations are developed for three types of spectral subdivisions: Schumann-Runge band intervals, 500 inverse cm and 10 intervals. The approximations are valid from the lower thermosphere down to the stratosphere and can be applied for a wide range of atmospheric models and solar zenith distances.
Author (ESA)

N76-28713*# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE MORPHOLOGY OF ENERGETIC O(PLUS) IONS DURING TWO MAGNETIC STORMS: LATITUDINAL VARIATIONS
R. D. Sharp, R. G. Johnson, and E. G. Shelley [1974] 28 p refs
(Contracts NASw-2777; F44620-73-C-0050)
(NASA-CR-148530) Avail: NTIS HC $4.00 CSCL 04A

The investigation of the mechanism responsible for the acceleration of cold ionospheric plasma up to energies of 12 keV is reported. Results are presented of a study of precipitating O(+) and H(+) ions with energies between 0.7 and 12 keV during the magnetic storms of December 16 and 17, 1971. The latitudinal variations of the properties of the precipitating ions are examined and some features of the O(+) energy spectrums which may represent signatures of the unknown acceleration mechanism responsible for their energization are discussed. Some of the principal findings are: (1) the O(+) energy spectrums were generally quite structured with one or more peaks being frequently observed; (2) O(+) energy spectrums which were still rising at 12 keV were not uncommon, particularly at high latitudes; (3) several examples of a spectral peak moving systematically to higher energy with increasing latitude were found; (4) precipitating O(4) ions in the magnetosphere at L less than or equal to 2 were found in association with a large main phase decrease in Dst. Author

N76-28714*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
LOW-ENERGY ELECTRON INTENSITIES AT LARGE DISTANCES OVER THE EARTH'S POLAR CAP
D. M. Yeager and L. A. Frank Nov. 1975 47 p refs
(Contract NAS5-9074; Grant NGL-16-001-002)
(NASA-CR-148470; U-of-Iowa-75-40) Avail: NTIS HC $4.00 CSCL 04A

The results of the character and temporal fluctuations study of electron intensities in the energy range of hundreds of electron volts, are reported which were measured at high latitudes and altitudes on geomagnetic field lines corresponding to those of the polar cap and magnetotail lobes. It is concluded that such electron intensities are diminutive relative to those found in other regions of the magnetosphere. Severe variations of intensities were found and the magnitudes of electron intensities appear to be strongly coupled to the directions of the interplanetary magnetic fields. Author

N76-28715*# Science Applications, Inc., La Jolla, Calif.
IONOSPHERIC PLASMA CLOUD DYNAMICS Final Report
Jul. 1976 40 p refs
(Contract NASw-2602)
(NASA-CR-148507; SAI-76-680-LJ) Avail: NTIS HC $4.00 CSCL 04A

Measurements of the thermospheric neutral wind and ionospheric drift made at Eglin AFB, Florida and Kwajalein Atoll are discussed. The neutral wind measurements at Eglin had little variation over a period of four years for moderate magnetic activity (Kp < 4); the ionospheric drifts are small. Evidence is presented that indicates that increased magnetic activity has a significant effect on the neutral wind magnitude and direction at this midlatitude station. The neutral wind at dusk near the equator is generally small although in one case out of seven it was significantly larger. It is described how observations of large barium releases can be used to infer the degree of electrodynamic coupling of ion clouds to the background ionosphere. Evidence is presented that indicates that large barium releases are coupled to the conjugate ionosphere at midlatitudes. Author

N76-28716*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROBING THE EARTH'S GRAVITY FIELD USING SATELLITE-TO-SATELLITE TRACKING (SST)
F. O. Vonbun Feb. 1976 21 p refs Submitted for publication
(NASA-TM-X-71142; X-900-76-40) Avail: NTIS HC $3.50 CSCL 08N

Satellite-to-Satellite (SST) tests, namely: (a) the ATS-6/GEOS-3 and (b) the ATS-6/Apollo-Soyuz experiment and some of the results obtained are described. The main purpose of these two experiments was first to track via ATS-6 the GEOS-3 as well as the Apollo-Soyuz and to use these tracking data to determine (a) both orbits, that is, ATS-6, GEOS-3 and/or the Apollo-Soyuz orbits at the same time; (b) each of these orbits alone; and (c) test the ATS-6/GEOS-3 and/or Apollo-Soyuz SST link to study local gravity anomalies; and, second, to test communications, command, and data transmission from the ground via ATS-6 to these spacecraft and back again to the ground. The Apollo-Soyuz Geodynamics Experiment is discussed in some detail. Author

N76-28717*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
MEASUREMENT OF OZONE TRANSMISSIVITY AT LOW TEMPERATURES Final Report, 1 Mar. 1974 - 31 May 1975
F. L. Bartman, L. T. Loh, and W. R. Kuhn Jul. 1976 32 p refs
(Grant NsG-1003)
(NASA-CR-148161; ORA-012627) Avail: NTIS HC $4.00 CSCL 04A

Low temperature medium resolution measurements of the transmissivity of the ozone band have been made in the laboratory. The range of conditions under which the measurements were made are: -48 ≤ to ≤ -22 C, .0029 < U < .71 atm.cm., 680 < P < 742 mmHg. The apparatus used is described briefly, measurement conditions are summarized and the resulting spectra are shown. Author

N76-28718*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE PREDICTION OF ZENITH RANGE REFRACTION FROM SURFACE MEASUREMENTS OF METEOROLOGICAL PARAMETERS
Allen L. Berman 15 Jul. 1976 47 p refs
(Contract NAS7-100)
(JPL-TR-32-1602) Avail: NTIS HC $4.00 CSCL 04A

In the last two decades, increasingly sophisticated deep space missions have placed correspondingly stringent requirements on navigational accuracy. As part of the effort to increase navigational accuracy, and hence the quality of radiometric data, much effort has been expended in an attempt to understand and compute the tropospheric effect on range (and hence range rate) data. The general approach adopted has been that of computing a zenith range refraction, and then mapping this refraction to any arbitrary elevation angle via an empirically derived function of elevation. The prediction of zenith range refraction derived from surface measurements of meteorological parameters is presented. Refractivity is separated into wet (water vapor pressure) and dry (atmospheric pressure) components. The integration of dry refractivity is shown to be exact. Attempts to integrate wet refractivity directly prove ineffective; however, several empirical models developed by the author and other researchers at JPL are discussed. The best current wet refraction model is here considered to be a separate day/night model, which is proportional

to surface water vapor pressure and inversely proportional to surface temperature. Methods are suggested that might improve the accuracy of the wet range refraction model. Author

N76-28719*# Stanford Univ., Calif. Radioscience Lab.
THE RESPONSE OF THE IONOSPHERE TO THE INJECTION OF CHEMICALLY REACTIVE VAPORS
Paul Alan Bernhardt May 1976 262 p refs
(Contract NAS8-31769; Grant NGR-05-020-001)
(NASA-CR-149941; SU-SEL-76-009; SU-TR-17) Avail: NTIS HC $9.00 CSCL 04A

As a gas released in the ionosphere expands, it is rapidly cooled. When the vapor becomes sufficiently tenuous, it is reheated by collisions with the ambient atmosphere and its flow is then governed by diffusive expansion. As the injected gas becomes well mixed with the plasma, a hole is created by chemical processes. In the case of diatomic hydrogen release, depression of the electron concentrations is governed by the charge exchange reaction between oxygen ions and hydrogen, producing positive hydroxyl ions. Hydroxyl ions rapidly react with the electron gas to produce excited oxygen and hydrogen atoms. Enhanced airglow emissions result from the transition of the excited atoms to lower energy states. The electron temperature in the depleted region rises sharply causing a thermal expansion of the plasma and a further reduction in the local plasma concentration.

N76-28720*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LODESTONE: NATURE'S OWN PERMANENT MAGNET
Peter Wasilewski Jun. 1976 33 p refs Submitted for publication
(NASA-TM-X-71145; X-691-76-110) Avail: NTIS HC $4.00 CSCL 08N

Magnetic hysteresis and microstructural details are presented which explain why the class of magnetic iron ores defined as proto-lodestones, can behave as permanent magnets, i.e. lodestones. Certain of these proto-lodestones which are not permanent magnets can be made into permanent magnets by charging in a field greater than 1000 oersted. This fact, other experimental observations, and field evidence from antiquity and the middle ages, which seems to indicate that lodestones are found as localized patches within massive ore bodies, suggests that lightning might be responsible for the charging of lodestones. The large remanent magnetization, high values of coercive force, and good time stability for the remanent magnetization are all characteristics of proto-lodestone iron ores which behave magnetically as fine scale (< 10 micrometer) intergrowths when subjected to magnetic hysteresis analysis. The magnetic results are easily understood by analysis of the complex proto lodestone microstructural patterns observable at the micrometer scale and less. Author

N76-28721# Geological Survey, Arlington, Va.
EARTHQUAKE PREDICTION: OPPORTUNITY TO AVERT DISASTER
1975 40 p Conf. held in San Francisco, 7 Nov. 1975
(USGS-Circ-729; LC-76-600005) Avail: NTIS HC $4.00

The conference was held to review the prospects for earthquake prediction in the United States and to present a Federal plan for issuance of earthquake forecasts. Topics discussed include: earthquake forecasting, role of state governments in earthquake warning, status of earthquake prediction, possible loss-reduction actions, and the social, economic, and political implications of earthquake predictions. F.O.S.

N76-28722*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
POSITIVE ION DENSITIES AND MOBILITIES IN THE UPPER STRATOSPHERE AND MESOSPHERE
Steve Leiden 13 Jul. 1976 61 p refs
(Grant NsG-6004)
(NASA-CR-148489; PSU-IRL-SCI-446) Avail: NTIS HC $4.50 CSCL 04A

A brief sketch of the theory concerning the use of the Gerdien condenser as a mobility spectrometer is presented. Data reduction of three parachute borne Gerdien condenser probes is given, as well as that of one blunt conductivity probe. Comparisons of concentrations calculated by two different methods indicate consistency of results. Mobility profiles demonstrating remarkable fine structure are discussed in detail. Finally, theoretical implications of the results on ionospheric structure, including possible night-day differences and latitudinal variations, are considered. Author

N76-28723*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
ROCKET-BORNE TIME-OF-FLIGHT MASS SPECTROMETRY
Robert F. Reiter Aug. 1976 239 p refs
(Grant NGR-39-009-032)
(NASA-CR-148504; PSU-IRL-SCI-444) Avail: NTIS HC $8.00 CSCL 03A

Theoretical and numerical analyses are made of planar, cylindrical and spherical-electrode two-field time-of-flight mass spectrometers in order to optimize their operating conditions. A method is introduced which can improve the resolving power of these instruments by a factor of 7.5. Potential barrier gating in time-of-flight mass spectrometers is also analyzed. Experimental studies of a miniature cylindrical-electrode and a hemispherical-electrode time-of-flight mass spectrometer are presented. Their sensitivity and ability to operate at D-region pressures with an open source make them ideal instruments for D-region ion composition measurements. A sounding rocket experiment package carrying a cylindrical electrode time-of-flight mass spectrometer was launched. The data indicate that essentially 100% of the positive electric charge on positive ions is carried by ions with mass-to-charge ratios greater than 500 below an altitude of 92 km. These heavy charge carriers were present at altitudes up to about 100 km. Author

N76-28724*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINING ELEMENTS OF DRIFT OF THE ICE COVER AND MOVEMENT OF THE ICE EDGE BY THE AID OF THE TOROS AIRCRAFT LATERAL SCAN RADAR STATION
V. S. Loshchilov and V. A. Voyevodin Washington NASA Aug. 1976 16 p refs Transl. into ENGLISH from Problemy Artiki i Antartiki (Leningrad), no. 40, 1972 p 23-30
(Contract NASw-2791)
(NASA-TT-F-17121) Avail: NTIS HC $3.50 CSCL 08L

A brief presentation is given of a method of radar survey of ice. This can be used for determining elements of drift. Experimental results are discussed. Author

N76-28725*# Transemantics, Inc., Washington, D.C.
CONTRIBUTION TO THE THEORY OF SEASONAL VARIATION IN ATMOSPHERIC OZONE
A. V. Artemyev NASA Jun. 1976 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Fiz. Atmos. Okeana (USSR), vol. 11, Nov. 1975 p 1161-1168
(NASw-2792)
(NASA-TT-F-15485) Avail: NTIS HC $3.50 CSCL 04A

Observed variations in atmospheric ozone are accounted for by solving the appropriate nonstationary problem of ozone distribution as affected by advection and macroturbulence processes and also by photochemical processes, with more rigorous treatment of all the basic photochemical reactions involved. Data on the observed amount of ozone in the troposphere can be exploited only by considering tropospheric ozone sources and by evaluating their seasonal intensity as a function of latitude (vertical distribution of total ozone content by latitude in the various seasons). The two dimensional nonstationary problem of ozone distribution in the meridional plane in response to a set of dynamic and photochemical factors is solved numerically, and results fit theoretical prediction closely. Author

N76-28726*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ION COMPOSITION IN A NOCTILUCENT CLOUD
R. A. Goldberg and G. Witt (Stockholm Univ.) Jul. 1976 45 p refs Submitted for publication
(NASA-TM-X-71161; X-912-76-133) Avail: NTIS HC $4.00 CSCL 04A

Ion composition at mesospheric altitudes was measured and compared between high and mid-latitude sites under summer daytime conditions. Rocket-borne measurements were made with pumped quadrupole ion mass spectrometers. The mid-latitude

data were obtained at Wallops Island, Virginia on June 30, 1973, at 1510 LMT. Large quantities of hydronium cluster ions were observed through 109+, with maximum concentrations at 55+ and 73+. Also, cluster ions of nitric oxide were observed through 84+. The high latitude launch occurred at Kiruna, Sweden on August 2, 1973, at 0700 LMT following visual sighting of a noctilucent cloud on the prior evening. The data near mesopause shows cluster ions, but also a preponderance of heavy ions between 90 and 145 AMU, with groupings 18 AMU apart but unrelated to the more typical cluster ions. One possible set of consistent identifications leads to iron and iron oxide hydrates. These results may suggest the presence of metallic particulates and ions which form hydrated clusters ions. Author

N76-28727*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH-ATMOSPHERE SYSTEM AND SURFACE REFLECTIVITIES IN ARID REGIONS FROM LANDSAT MULTISPECTRAL SCANNER MEASUREMENTS
J. Otterman and R. S. Fraser Jun. 1976 40 p refs Submitted for publication
(NASA-TM-X-71164; X-911-76-147) Avail: NTIS HC $4.00 CSCL 04A

Programs for computing atmospheric transmission and scattering solar radiation were used to compute the ratios of the Earth-atmosphere system (space) directional reflectivities in the vertical direction to the surface reflectivity, for the four bands of the LANDSAT multispectral scanner (MSS). These ratios are presented as graphs for two water vapor levels, as a function of the surface reflectivity, for various sun elevation angles. Space directional reflectivities in the vertical direction are reported for selected arid regions in Asia, Africa and Central America from the spectral radiance levels measured by the LANDSAT MSS. From these space reflectivities, surface vertical reflectivities were computed applying the pertinent graphs. These surface reflectivities were used to estimate the surface albedo for the entire solar spectrum. The estimated albedos are in the range 0.34-0.52, higher than the values reported by most previous researchers from space measurements, but are consistent with laboratory measurements. Author

N76-28728# Army Construction Engineering Research Lab., Champaign, Ill.
MODAL ANALYSIS METHODS IN SEISMIC DESIGN FOR BUILDINGS Final Report, Aug. 1974 - Feb. 1975
William K. Stockdale Jun. 1975 37 p refs
(DA Proj. 4A7-6719-AT-05)
(AD-A012732; CERL-TR-M-132) Avail: NTIS CSCL 13/13

The first step in preparing a change to the tri-services manual TM 5-809-10 is presented, Seismic Design for Buildings. Changes in this manual are necessary to provide guidance for the design of critical military facilities which must remain functional after subjection to strong earthquakes. This report describes and discusses modal analysis methods used in the dynamic analysis of structures in conjunction with the earthquake response spectra and time history methods. Elastic and inelastic conditions are discussed, as well as structural damping and assumptions and limitations of the methods. Example calculations are included. Author

N76-28729# Army Construction Engineering Research Lab., Champaign, Ill.
GUIDELINES FOR DEVELOPING DESIGN EARTHQUAKE RESPONSE SPECTRA Final Report
Walter W. Hays, S. T. Algermissen, Alvaro F. Espindsa, David M. Perkins, and Wilbur A. Rinehart Jun. 1975 363 p
(AD-A012728; CERL-TR-M-114) Avail: NTIS CSCL 13/13

State-of the-art information required for developing design earthquake response spectra is compiled and synthesized in a manual-like format to provide the user with general guidelines for estimating the ground motion load expected for sites of interest located throughout the United States. The information contained in this document constitutes a subset of the comprehensive body of knowledge available in the field. This subset is considered pertinent for a technical understanding of the theoretical and empirical bases currently used to develop design earthquake response spectra for use in construction, design, and evaluation of important facilities. Author

N76-28730# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Science Lab.
ATS OBSERVATIONS OF SUDDEN INCREASES OF TOTAL ELECTRON CONTENT INDUCED BY EUV AND X-RAY BURST OF SOLAR FLARES
R. F. Donnelly and R. B. Fritz Sep. 1975 43 p refs
(PB-249588/5; NOAA-TR-ERL-347; SEL-35;
NOAA-76011610) Avail: NTIS HC $4.00 CSCL 04A

Satellite observations (ATS-6) of sudden increases in total electron content (SITECs) produced by extreme ultraviolet (EUV) and X-ray bursts of solar flares are presented quantitatively and interpreted qualitatively. Large SITECs for the white light flare of July 4, 1974, and for the large flares on July 5, September 10, and September 19, 1974, are illustrated. The time rate of change of total electron content dN sub T/dt was directly compared with SFD (Sudden Frequency Deviations) measurements. GRA

N76-28731# Sandia Labs., Albuquerque, N.Mex.
PREDICTIONS OF PROJECTILE PENETRATION PHENOMENA AND COMPARISON WITH EXPERIMENTS IN A SOIL MEDIUM Final Report, Feb. 1974 - Jan 1975
R. K. Byers, A. J. Chabai, and R. T. Walsh 8 Oct. 1975 364 p refs
(DNA Proj. NWET-L35IAXSX338)
(AD-A020179; SAND-75-0174) Avail: NTIS CSCL 19/1

Results of calculations are presented to predict effects of earth penetration experiments conducted in mid-July 1974 at the Watching Hill site of the Defense Research Establishment, Alberta. Calculations were performed with the TOODY Lagrangian code for both a rigid and deformable projectile. Soil cap models describing four layers of the glacial silt target were employed in the calculations. All calculations are for a projectile 0.1651 m in diameter (6.5 in.), of mass 181.44 kg (400 lbs.) with tangent ogive nose shape impacting the earth target at a velocity of 152.4 m/s (500 ft/sec). A zero friction boundary condition is employed at the projectile-soil interface. Stress, strain, and velocity distributions, produced in the medium by the penetrating projectile, are computed. Axial retarding forces exerted by the medium on the projectile and normal stress distributions on the projectile surface are also calculated. Comparisons of predictions with experimental measurements of rigid body projectile deceleration and soil stress histories indicate that computer simulations should be able to provide a detailed and reasonably accurate description of soil response and projectile motion during penetration. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-28732 Oklahoma Univ., Norman.
A VARIATIONAL OPTIMIZATION ANALYSIS APPROACH TO CONTINUOUS DATA ASSIMILATION Ph.D. Thesis
Adrian Augustus Ritchie 1975 111 p
Avail: Univ. Microfilms Order No. 76-158222

The assimilation or dynamic matching of asynoptic meteorological data with existing forecast fields, in space and time, is necessary to obtain the maximum benefit from the new data and to preclude the excitation of large amplitude inertial gravity waves. Prognostic fields of wind and geopotential, produced by the nonlinear longwave equations, plus simulated asynoptic geopotential observations are matched by the numerical variational analysis method. The linearized balance equation, integrated continuity equation, and observations weakly constrain the analysis. The three coupled assimilation equations are solved as a boundary value problem by a cyclic relaxation technique. The response function is investigated for a simpler system of analysis equations which result when horizontal nondivergence is used as a constraint instead of the integrated continuity equation. The response functions show that amplification, phase shifting, and anisotropic filtering occur in the dynamic matching process. Dissert. Abstr.

N76-28733 Oklahoma Univ., Norman.
THE MODIFICATION AND APPLICATION OF KUO'S PARAMETERIZATION OF CUMULUS CONVECTION IN MIDDLE LATITUDES Ph.D. Thesis
Wen-Jey Liang 1975 103 p
Avail: Univ. Microfilms Order No. 76-15811

The applicability of Kuo's parameterization of cumulus convection in the middle latitudes is examined, and a modification of his theory is developed. An evaluation of Kuo's scheme is performed to reveal physical insight into the involved mechanisms through a combination of the large-scale heat and moisture budgets and Kuo's formulation of the latent heat released. In order to improve upon the treatment of the interaction of deep convection with the environment, modifications consisting of considerations of the large-scale moisture supply and of the vertical transport of moisture and of dry static energy inside the cloud are made. Also, a two-layer cloud ensemble model is combined with the modified scheme. An examination of the modified scheme is performed by combining the large-scale heat and moisture budgets, and the modified formulation of the latent heat released. The modified parameterization procedures are compared with Kuo's original scheme, and the results of tests of both schemes are discussed. Dissert. Abstr.

N76-28734 Wisconsin Univ., Madison.
ATMOSPHERIC CIRCULATION SINGULARITIES IN THE NORTHERN HEMISPHERE Ph.D. Thesis
Richard Allen Kalnicky 1975 187 p
Avail: Univ. Microfilms Order No. 76-8592

The most significant hemispheric circulation singularities during 1899-1969 are identified. Eigenvector analysis of daily frequencies of regional and hemispheric circulation types identifies characteristic combinations of circulation types. Annual trends are evident in frequencies of these circulation type combinations. Circulation assemblages apparent in the annual trend during 1899-1969 are a summer group, associated with extensive subtropical oceanic highs; winter group, with polar anticyclones over continents; meridional group in spring and early autumn; and zonal group with anticyclones in lower middle latitudes in late autumn. A daily index of change identifies times of most abrupt change in the annual trend of hemispheric circulation. Sixteen most significant intervals of discontinuity occur in the annual trend. These intervals of discontinuity are about one-tenth the length of the stable episodes between. Dissert. Abstr.

N76-28735 California Univ., Los Angeles.
THE SURVIVAL OF CIRRUS ICE PARTICLES FALLING BENEATH CIRRUS CLOUDS IN SUBSATURATED AIR Ph.D. Thesis
William David Hall 1976 195 p
Avail: Univ. Microfilms Order No. 76-15938

The survival of cirrus ice particles falling beneath cirrus clouds in subsaturated air was studied. The relevant microphysical processes which determine the survival distance of ice crystals precipitating from cirrus clouds was analyzed and the atmospheric conditions necessary for such ice particles to seed lower level supercooled clouds thus initiating glaciation in these clouds was determined. The approach chosen consisted of developing a set of differential equations which describe the simultaneous heat and mass transfer of an evaporating cirrus ice particle. In the present theoretical model three differently shaped ice particles; a spherical ice particle, a columnar ice particle, and a plate-like ice particle were studied. The mass transfer equation considered diffusional mass transfer modified by forced convection and kinetic theory limitations. The heat transfer equation considered thermal diffusion modified by forced convection and kinetic theory limitations. Radiative heat exchanged between an ice particle and its environment was also considered. Dissert. Abstr.

N76-28736 Kansas Univ., Lawrence.
LABORATORY AND FIELD INVESTIGATION OF WINDGENERATED WAVES AND CURRENTS Ph.D. Thesis
Kenneth Susumu Ozawa 1975 114 p
Avail: Univ. Microfilms Order No. 76-16761

The purpose of this study is to determine experimentally the characteristics of wind-generated waves and current in a laboratory channel and in La Cygne Lake. Measurements of air velocity distributions, surface waves, and velocity distribution in water in a laboratory wind-wave channel are used to determine the effects of wind speed and fetch on the wind-generated waves and the current velocity. Measurements of surface waves and drift velocity in La Cygne Lake are used to determine the properties of wind-generated waves and currents. The lake currents however are not caused by wind alone when the water is recirculated by pumping. The longitudinal dispersion coefficients in the laboratory channel and in La Cygne Lake are also determined from dye dispersion tests. The mean air velocity distribution in the turbulent boundary layer over the water surface in the laboratory channel is found to obey the logarithmic law. Dissert. Abstr.

N76-28737 George Washington Univ., Washington, D.C.
SOLUTIONS TO A TURBULENT TWO-CELL BUOYANCY DRIVEN TORNADO VORTEX MODEL Ph.D. Thesis
William Marshall Kendall 1976 181 p
Avail: Univ. Microfilms Order No. 76-16261

The main purpose of this search was to derive a unified theory relevant to the dynamics of the main flow field of a buoyancy-driven tornado and to obtain steady and unsteady two-cell similarity solutions and a steady-state numerical solution. The mathematical model was derived based on the continuity equation, equations of motion, energy equation, equation of state and basic state equations (tropospheric temperature distribution, hydrostatic equation and equation of state for a perfect gas). These equations were formulated for axisymmetric viscous flow under the Boussinesq approximation in a fixed cylindrical co-ordinate system and were nondimensionalized. Unstable stratification and large vorticity were taken as the two most important factors essential for the formation of a tornado. Unstable stratification acts as a sink since it induces strong vertical velocities which in turn cause horizontal convergence. Dissert. Abstr.

N76-28738*# Helio Associates, Inc., Tucson, Ariz.
SOLAR MICROCLIMATOLOGY Final Report
Dean B. McKenney and William T. Beauchamp Nov. 1975 71 p refs
(Contract NASw-2745)
(NASA-CR-148533) Avail: NTIS HC $4.50 CSCL 04B

It has become apparent in recent years that solar energy can be used for electric power production by several methods. Because of the diffuse nature of the solar insolation, the area involved in any central power plant design can encompass several square miles. A detailed design of these large area collection systems will require precise knowledge of the local solar insolation. Detailed information will also be needed concerning the temporal nature of the insolation and the local spatial distribution. Therefore, insolation data was collected and analyzed for a network of sensors distributed over an area of several square kilometers in Arizona. The analyses of this data yielded probability distributions of cloud size, velocity, and direction of motion which were compared with data obtained from the National Weather Service. Microclimatological analyses were also performed for suitable modeling parameters pertinent to large scale electric power plant design. Instrumentation used to collect the data is described. Author

N76-28739*# Kanner (Leo) Associates, Redwood City, Calif.
NEW DEVELOPMENTS IN THE THEORY OF CLIMATE (THEORETICAL MODELS OF CLIMATE: RECENT CLIMATIC CHANGES AND THEIR DETERMINING FACTORS)
K. Ya. Kondratyev Washington NASA Aug. 1976 81 p refs Transl. into ENGLISH of the book "Novoye v Teorii Klimata (Teoreticheskiye Modeli Klimata; Sovremennyye Izmeneniya Klimata i Opredelyayushchiye ikh Faktory)" Leningrad, Hydrometeorological Press, 1976 p 1-65
(Contract NASw-2790)
(NASA-TT-F-17119) Avail: NTIS HC $5.00 CSCL 04B

A brief discussion of the basic direction in the modern theory of climate is presented; semiempirical methods, the concept of radiative convective equilibrium, zonal atmospheric models, and complete three dimensional modeling. Considered are some results of the application of numerical modeling for evaluating the different climatic factors. A detailed treatment is given concerning views on the effect of variations in the composition of stratospheric gases and aerosol on climate. Special attention is paid to the problem of the ozone layer formation and the effect of minor

gaseous components (nitrogen oxides, in particular) on the ozone concentration field. Data are given concerning the role of ozone, nitrogen dioxide, and aerosol as optically active components of the stratosphere. Author

N76-28740# Federal Aviation Administration, Washington, D.C.
WIND SHEAR PROGRAM DATA MANAGEMENT PLAN
Eric Mandel, Larry Goodwin, and Jim DeMattio Apr. 1976 36 p
(AD-A024543/1; FAA-RD-76-25) Avail: NTIS HC $4.00 CSCL 01/3

This plan outlines the data collection efforts of the Wind Shear Program. A set of standard data collection, processing, and analysis requirements are presented, which include: (1) an outline of the parameters to be recorded and the associated accuracies, resolutions, ranges, bandwidths, and timing requirements necessary to study the wind shear frequencies affecting aircraft; (2) the test site conditions for each of the ground-based data collection sites; (3) a listing of the type of sensors and their location for each data collection effort; and (4) the wind shear data base functional requirements. Author

N76-28741*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
THE INTERACTION OF UNIDIRECTIONAL WINDS WITH AN ISOLATED BARCHAN SAND DUNE
Mohamed Gad-el-Hak, Deborah Pierce, Alan Howard, and Jeffrey B. Morton Jul. 1976 109 p refs
(Grant NGR-47-005-172)
(NASA-CR-148540; UVA/528035/ESS76/102) Avail: NTIS HC $5.50 CSCL 04B

Velocity profile measurements are determined on and around a barchan dune model inserted in the roughness layer on the tunnel floor. A theoretical investigation is made into the factors influencing the rate of sand flow around the dune. Flow visualization techniques are employed in the mapping of streamlines of flow on the dune's surface. Maps of erosion and deposition of sand are constructed for the barchan model, utilizing both flow visualization techniques and friction velocities calculated from the measured velocity profiles. The sediment budget found experimentally for the model is compared to predicted and observed results reported. The comparison shows fairly good agreement between the experimentally determined and predicted sediment budgets. Author

N76-28742*# Stanford Univ., Calif. Inst. for Plasma Research.
STUDY OF THE RELATIONSHIP BETWEEN SOLAR ACTIVITY AND TERRESTRIAL WEATHER
P. A. Sturrock, G. E. Brueckner, R. E. Dickinson, N. Fukuta, L. J. Lanzerotti, R. S. Lindzen, C. G. Park, and J. M. Wilcox Aug. 1976 28 p refs
(Grant NGL-05-020-272)
(NASA-CR-148541; SU-IPR-671) Avail: NTIS HC $4.00 CSCL 04B

Evidence for some connection between weather and solar related phenomena is presented. Historical data of world wide temperature variations with relationship to change in solar luminosity are examined. Several test methods for estimating the statistical significance of such phenomena are discussed in detail. B. B.

N76-28743# World Meteorological Organization, Geneva (Switzerland).
AUTOMATED METEOROLOGICAL SYSTEMS
1975 398 p refs Partly in ENGLISH and partly in FRENCH Proc. of WMO Tech. Conf. (Tecams), Washington, D. C., 14-19 Feb. 1975.
(WMO-420; ISBN-92-63-10420-4) Avail: NTIS HC $10.75; WMO, Geneva Sw. Fr. 58

The conference was held to stimulate the timely exchange of information relating to design, test, and evaluation of new automatic and semi-automatic meteorological stations. Papers in the following items were presented: general aspects of automation, design problems, development of new sensors, operational experience, and stations for special purposes. For individual titles, see N76-28744 through N76-28791.

N76-28744 World Meteorological Organization, Geneva (Switzerland).
THE PRESENT AND FUTURE POSSIBILITIES OF AUTOMATIC WEATHER STATIONS [LES STATIONS METEOROLOGIQUES AUTOMATIQUES: POSSIBILITES ACTUELLES ET FUTURES]
H. P. Treussart *In its* Automated Meteorol. Systems 1975 p 1-11 refs In FRENCH (For availability see N76-28743 19-47)
Copyright.

The possibilities offered by automatic weather stations necessitates a rethink of the tasks they can perform. Comments on the conditions in which these tasks could evolve and in the characteristics of equipment resulting from this evolution are made. The problems posed by present utilization of automatic weather stations are addressed - these include environmental weather conditions, staffing, choice of parameters to measure, and sensors. Other types of automatic weather stations such as satellites, buoys and ships are also briefly discussed. ESA

N76-28745 World Meteorological Organization, Geneva (Switzerland).
USER REQUIREMENTS FOR AUTOMATED METEOROLOGICAL SYSTEMS
E. Fawcett *In its* Automated Meteorol. Systems 1975 p 12-18 (For availability see N76-28743 19-47)
Copyright.

A brief status report on operational forecasting is given and an attempt is made to relate this to general requirements for instruments. The requirements for instruments are summarized and accuracy and reliability are especially emphasized using a diagram of the vertical structure of a numerical prediction model of the atmosphere. The importance of meteorological parameters used to initialize large-scale numerical models is also noted.ESA

N76-28746 World Meteorological Organization, Geneva (Switzerland).
SOME TECHNIQUE PROBLEMS OF METEOROLOGICAL MEASUREMENTS AND DEVELOPMENT OF AUTOMATED OBSERVATIONAL SYSTEMS
B. G. Rozdestvenskii and V. A. Yurmanov *In its* Automated Meteorol. Systems 1975 p 19-21 (For availability see N76-28743 19-47)
Copyright.

Technical problems connected with the modification of measurement in the meteorological network and the development of automated observational systems in the U.S.S.R. are discussed. In particular errors and the accessory of measurements are noted. The combination of visual as well as automatic observation is stressed. ESA

N76-28747 World Meteorological Organization, Geneva (Switzerland).
A CONTINUOUS REMOTE DISPLAY SYSTEM FOR AIRFIELD USE **c35**
D. J. Painting *In its* Automated Meteorol. Systems 1975 p 22-29 refs (For availability see N76-28743 19-47)
Copyright.

A system, known as the Continuous Automatic Remote Display (CARD), developed for the continuous display of meteorological variables from remote unnamed sites is discussed. The sensor suite, remote station electronics, and receiving station are described and application and future developments are summarized. ESA

N76-28748 World Meteorological Organization, Geneva (Switzerland).
AUTOMATIC WEATHER STATIONS FOR USE AT AIRPORTS [STATIONS AUTOMATIQUES D'OBSERVATION METEOROLOGIQUE SUR AERODROME]
C. Fichaux *In its* Automated Meteorol. Systems 1975 p 31-37 In FRENCH (For availability see N76-28743 19-47)
Copyright.

Two automatic weather systems for use at French airports are described. The first (SAOMA) is based on a microprocessor with the task of determining visibility. The functioning, sensors, processing and general organization of the station are described. The second system (IMCA) is intended to provide the user with details of a large number of meteorological parameters, including

wind direction and speed, cloud height, air temperature and humidity and pressure. This system is based on a minicomputer, the characteristics of which are outlined, and allows video as well as numeric output. ESA

N76-28749 World Meteorological Organization, Geneva (Switzerland).
AUTOMATION OF METEOROLOGICAL OBSERVATIONS AT HELSINKI AIRPORT
K. Luukkonen and K. Karhunen *In its* Automated Meteorol. Systems 1975 p 38-44 (For availability see N76-28743 19-47)
Copyright.

The background, functions, configuration, sensors, input, data processing facilities, output, and implementation of a system based on a minicomputer and designed for the automation of meteorological observations at Helsinki airport are described. ESA

N76-28750 World Meteorological Organization, Geneva (Switzerland).
ECONOMICAL WIND TELEMETRY SYSTEM FOR MESOSCALE OPERATION
M. Mezoesi *In its* Automated Meteorol. Systems 1975 p 45-51 (For availability see N76-28743 19-47)
Copyright.

The background to the requirements for an economical wind VHF telemetry system in Hungary are outlined followed by the engineering design philosophy and a description of the system. Operational experience is also summarized. ESA

N76-28751 World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL MAGNETIC EVENT RECORDER c35
John M. Cook *In its* Automated Meteorol. Systems 1975 p 52-57 ref (For availability see N76-28743 19-47)
Copyright.

A battery operated magnetic recording system designed to fulfill a requirement of the Canadian climatological network for a system that could be used with existing sensors and ink recorders, but that would provide records more easily for computer analyses is discussed. The basic principles, recording format, sensor interfacing data reduction and data capacity features are described. ESA

N76-28752 World Meteorological Organization, Geneva (Switzerland).
DATA QUALITY: A SYSTEMS APPROACH
G. W. Withee and W. C. Blasingame *In its* Automated Meteorol. Systems 1975 p 58-66 refs (For availability see N76-28743 19-47)
Copyright.

An approach to the evaluation of data quality from synoptic automatic marine stations (buoys) is discussed. The method evaluates data quality by evaluating the impact to the data from all system components and system component/environment interactions. Examples are provided to show this technique can self-detect data quality deficiencies and can actually simplify the solution to data quality related problems. ESA

N76-28753 World Meteorological Organization, Geneva (Switzerland).
REQUIREMENTS OF MARINE METEOROLOGISTS [BESOINS DES METEOROLOGISTES MARITIMES]
J. M. Dury *In its* Automated Meteorol. Systems 1975 p 66-70 In FRENCH (For availability see N76-28743 19-47)
Copyright.

The responses of 16 national members of the Commission de Meteorologie Maritime who replied to a circular letter regarding their requirements for automated system are analyzed. In general all were in favor of increased automation, however, further cost data was required. Suggestions made by various national members are listed and ship-board sensors and instruments are discussed. ESA

N76-28754 World Meteorological Organization, Geneva (Switzerland).
SOME TECHNICAL MEANS FOR OBTAINING HYDROMETEOROLOGICAL DATA UNDER CONDITIONS OF COMPLEX AUTOMATION OF SHIP OBSERVATIONS
A. D. Bogachev, A. A. Fokin, I. P. Kuzminih, A. G. Roschin, and V. P. Teslenko *In its* Automated Meteorol. Systems 1975 p 71-78 (For availability see N76-28743 19-47)
Copyright.

The importance of ship-born automated systems for collecting and processing hydrometeorological data is stressed and the characteristics of Mars-1 - a ship automatic weather station - and a hydrologic sound-bathometer are described. ESA

N76-28755 World Meteorological Organization, Geneva (Switzerland).
THE MICROCOMPUTER IN METEOROLOGICAL INSTRUMENTATION c60
J. M. Pike and F. V. Brock *In its* Automated Meteorol. Systems 1975 p 79-84 refs (For availability see N76-28743 19-47)
Copyright.

The characteristics and capabilities of the Intel 8080 microcomputer are described and the advantages of using such microcomputers in automatic weather stations are discussed. Specific tasks given the microcomputer used in the NCAR/Portable Automated Mesonet (PAM) remote stations are outlined. ESA

N76-28756 World Meteorological Organization, Geneva (Switzerland).
EXPERIENCE WITH THE AIRMAP SYSTEM
Norman E. Gaut, Edward C. Reifenstein, David B. Spiegler, and James R. Mahoney *In its* Automated Meteorol. Systems 1975 p 85-94 (For availability see N76-28743 19-47)
Copyright.

A real-time air quality and micrometeorological monitoring network - AIRMAP (AIR Monitoring, Analysis and Prediction) - is described. The five major components: sensors and station facilities; telecommunication systems; central facility computers and meteorological data acquisition equipment; data analysis software and air quality prediction software are discussed in detail. Reliability, results and new developments are also covered. ESA

N76-28757 World Meteorological Organization, Geneva (Switzerland).
AN INTERROGABLE WEATHER OBSERVING SYSTEM FOR USE IN SYNOPTIC NETWORKS
K. J. T. Sands and B. Tonkinson *In its* Automated Meteorol. Systems 1975 p 95-103 refs (For availability see N76-28743 19-47)
Copyright.

A digital weather observing system -MOWOS - based on the concept of a central receiving station from which several remote stations can be interrogated through the public telephone network is reviewed. The automatic sequence of events at the remote stations is outlined and the sensor suite is described. Maintenance of the station and results are also discussed. ESA

N76-28758 World Meteorological Organization, Geneva (Switzerland).
THE CLIMATOLOGICAL AUTOMATED RECORDING STATION (CARS) c35
D. J. McKay *In its* Automated Meteorol. Systems 1975 p 104-113 (For availability see N76-28743 19-47)
Copyright.

The background to the design specification for a self-contained automatic weather station (CARS) is outlined together with the meteorological parameters required to be measured. The components of the system - recorder, sensors power supplies - are described and the utilization in the field of CARS is discussed. ESA

N76-28759 World Meteorological Organization, Geneva (Switzerland).
THE DESIGN OF AN AUTOMATIC WEATHER STATION FOR THE ARCTIC OCEAN
R. J. Grauman and R. G. Catlin *In its* Automated Meteorol. Systems 1975 p 114-122 refs (For availability see N76-28743 19-47)
Copyright.

A real time environmental prediction system for the Beaufort Sea designed to collect data most strongly affecting the safety

of drilling activities such as wind-waves and ice conditions, is discussed. The form of the station is described and specification guidelines for the instrumentation package are appended. ESA

N76-28760 World Meteorological Organization, Geneva (Switzerland).
AUTOMATIC CLOUD AMOUNT RECORDER
L. S. Magnusson *In its* Automated Meteorol. Systems 1975 p 123-127 (For availability see N76-28743 19-47)
Copyright.

An automatic cloud amount recorder is described which can determine the height and size of clouds by measuring the temperature at the cloud base. Experience in using the recorder is related and the construction of a more sophisticated model is discussed. ESA

N76-28761 World Meteorological Organization, Geneva (Switzerland).
AUTOMATED OBJECTIVE OBSERVATION TECHNIQUES FOR 'PRESENT WEATHER ELEMENTS'
A. N. Hill *In its* Automated Meteorol. Systems 1975 p 128-136 refs (For availability see N76-28743 19-47)
Copyright.

Efforts and developments in objective observation of meteorological parameters are reviewed. The instruments and techniques for reporting freezing, precipitation, thunderstorms, hail and sky conditions are described. The use of laser observations is also discussed. ESA

N76-28762 World Meteorological Organization, Geneva (Switzerland).
EXPERIMENTS WITH NEW GENERATION CEILOMETERS FOR POTENTIAL AUTOMATIC STATION USE
J. T. Bradley and M. Lefkowitz *In its* Automated Meteorol. Systems 1975 p 137-147 refs (For availability see N76-28743 19-47)
Copyright.

Experiments in which two new-generation ceilometers were compared with systems currently accepted as standard are reported. The primary purpose was to learn the extent an automated cloud observation based on a new ceilometer might differ from measurements made by systems currently in use. A second purpose was to gather ceilometer measurements to serve as a base for statistical tests. The results of the comparison are given. ESA

N76-28763 World Meteorological Organization, Geneva (Switzerland).
A NEW VERSATILE CUP ANEMOMETER SYSTEM FOR AUTOMATED DATA ACQUISITION
Max F. E. Hinzpeter *In its* Automated Meteorol. Systems 1975 p 148-157 ref (For availability see N76-28743 19-47)
Copyright.

The aims of the development of a wind sensing system using cup anemometers are outlined followed by a brief description of the equipment. Field experiment tests were carried out and subjected to time series analysis, the results of which are presented. ESA

N76-28764 World Meteorological Organization, Geneva (Switzerland).
INSTRUMENTAL EVALUATION OF CLOUDINESS c35
L. Tasso and G. Benedicti *In its* Automated Meteorol. Systems 1975 p 158-168 refs (For availability see N76-28743 19-47)
Copyright.

Three sensor techniques to evaluate cloud amount are described. The first is based on the difference in the infrared emission of clouds and clear sky and uses a net radiometer with suitable screening as a sensor. The second exploits the evaluation of the intensity of sky light in the two extreme visible regions using photoconductive cells as sensors. The third method evaluates the fraction of polarized light in sky light using photoconductors and phototransistors. Of the three methods, the first proves to be the most complete and valid for operational use. ESA

N76-28765 World Meteorological Organization, Geneva (Switzerland).
AUTOMATION OF CLOUD HEIGHT MEASUREMENTS
C. E. Robinson *In its* Automated Meteorol. Systems 1975 p 169-178 refs (For availability see N76-28743 19-47)
Copyright.

The general philosophy used in a cloud height processor is outlined with specific reference to the criteria which must be considered for choosing. The values of the related processor constants when used with existing beam ceilometers are presented. ESA

N76-28766 World Meteorological Organization, Geneva (Switzerland).
MICROPOWER SUNSHINE SENSOR FOR AWS c35
John M. Cook *In its* Automated Meteorol. Systems 1975 p 179-183 refs (For availability see N76-28743 19-47)
Copyright.

A solar sensor of equivalent performance to the Campbell Stokes, suitable for use at unattended automatic weather stations, is described. The principle of operation is based upon the appearance of distinct shadows with the onset of bright sunshine. The brightness of a surface illuminated by the sun is compared to the brightness of a surface in shade - the surfaces being scanned by photocells. The micropower electronics of the sensor are outlined and results of the performance are presented. ESA

N76-28767 World Meteorological Organization, Geneva (Switzerland).
VISIBILITY THROUGH VARIOUS OBSCURING MEDIA AS DETERMINED BY THE VIDEOGRAPH
B. E. Sheppard and W. L. Clink *In its* Automated Meteorol. Systems 1975 p 184-193 refs (For availability see N76-28743 19-47)
Copyright.

In an attempt to define a sensor for visibility, the characteristics of the videograph backscatter meter were investigated. The videograph is described and results of preliminary calibration experiments for the years from 23 November 1970 to 31 October 1971 are given. The calibration of the videograph, for a variety of weather conditions and ambient illumination levels, is presented in the form of graphs of the instrument output as a function of the prevailing visibility. ESA

N76-28768 Meteorological Research Inst., Tokyo (Japan).
AN OPTICAL SNOW DEPTHMETER (TWO-POLES TYPE)
N. Tsuda and H. Uotsu *In* WMO Automated Meteorol. Systems 1975 p 194-198 refs (For availability see N76-28743 19-47)
Copyright.

A two-pole type snow depthmeter in which the amount of snow depth is measured by an xenon flash light beam ascending between two poles is described. At the time of observation light source and detector capsules ascend simultaneously from the rest position of the poles until they emerge just above the snow surface at which time the detector receives the xenon flash. The characteristics of the depthmeter are given together with experimental results. An improved type of instrument is described. ESA

N76-28769 World Meteorological Organization, Geneva (Switzerland).
A MINICOMPUTER-CONTROLLED LIGHTNING EARLY WARNING/METEOROLOGICAL SYSTEM
W. W. Shurtleff *In its* Automated Meteorol. Systems 1975 p 199-206 (For availability see N76-28743 19-47)
Copyright.

A minicomputer-controlled lightning early warning system is described. It is essentially a generalized data acquisition and output system with all communication taking place over long distances. Its purpose is to collect potential gradient information from a matrix of sensors and retransmit this information to various installation and test sites. A secondary purpose is to collect meterological information from remote sites. ESA

N76-28770 World Meteorological Organization, Geneva (Switzerland).
OPERATIONAL EXPERIENCE WITH THE HUMICAP RELATIVE HUMIDITY SENSOR c35
O. Waehrn and P. Kostamo *In its* Automated Meteorol. Systems 1975 P 207-216 ref (For availability see N76-28743 19-47)

Copyright. Avail: NTIS

Test results of the Humicap relative humidity sensors are described. The Humicap is a capacitive type solid state device made by means of thin film deposition on a glass substrate. The humidity sensitive part is a one-micron thick polymer layer between capacitor plates. Calibration stability and high temperature tests were carried out. A version of the sensor with a protective coating against corrosion is also described. ESA

N76-28771 World Meteorological Organization, Geneva (Switzerland).

A WIND AVERAGING SYSTEM FOR AUTOMATIC WEATHER STATIONS c35

D. J. Painting *In its* Automated Meteorol. Systems 1975 p 217-223 refs (For availability see N76-28743 19-47)

Copyright.

A system for averaging wind speed and direction over a selected time period at remote sites is described. The input variable is compared with the output and the difference signal integrated in a continuous digital integrator to produce the new output. Operational experience and an evaluation program are described and an analysis of the results is made. It is concluded that the digital averaging circuits produce acceptable results compared with manual estimations. ESA

N76-28772 Hydrometeorological Service of the USSR.

DEVELOPMENT OF AUTOMATED SYSTEMS OF SURFACE HYDROMETEOROLOGICAL OBSERVATIONS IN THE USSR

K. N. Manuilov *In* WMO Automated Meteorol. Systems 1975 P 224-227 (For availability see N76-28743 19-47)

Copyright.

A historical survey of the development and use of automatic weather stations in the U.S.S.R. is given followed by an account of the next generation station. This station will measure some 15-20 meteorological parameters as well as carrying out additional functions such as early warning of storms. A system of complete automation of meteorological services in Byelorussia comprising 50 automatic stations connected by cable, radar observation of clouds and precipitation, meteorological satellite data acquisition system and automated atmospheric radiosounding is described and discussed. ESA

N76-28773 World Meteorological Organization, Geneva (Switzerland).

RELIABILITY OF SATIN: AUTOMATIC STATION FOR THE TRANSMISSION OF NUMERIC DATA [LA FIABILITE DE LA STATION AUTOMATIQUE A TRANSMISSION D'INFORMATION NUMERIQUE 'SATIN']

G. Lamboley and M. Lartigue *In its* Automated Meteorol. Systems 1975 p 228-235 In FRENCH (For availability see N76-28743 19-47)

Copyright.

Conceived to process data provided by eight sensors, the automatic weather station SATIN transmits automatically every hour, or on demand, a telegraphic message consisting of station identification and various meteorological parameters. The principles of the functioning of the system as well as a description are given followed by an analysis of the reliability of the instruments. ESA

N76-28774 World Meteorological Organization, Geneva (Switzerland).

USE OF RAMOS IN THE AFOS SYSTEM

D. L. Foster *In its* Automated Meteorol. Systems 1975 p 236-245 ref (For availability see N76-28743 19-47)

Copyright.

An effort to integrate the different types of automatic data collection programs with AFOS (Automation of Field Operation and Services), including RAMOS (Remote Automatic Meteorological Observing System) is discussed. A description of AFOS and RAMOS together with the required interface is given. Additionally, the early results and plans for the Tilghman Island RAMOS/AFOS project are discussed. ESA

N76-28775 World Meteorological Organization, Geneva (Switzerland).

AUTOMATIC CLIMATOLOGICAL MEASUREMENTS IN NORTH GREENLAND

L. Kristensen *In its* Automated Meteorol. Systems 1975 p 246-253 refs (For availability see N76-28743 19-47)

Copyright.

The background to the installation of an automatic climatological station (Unmanned Geophysical Observatory) at Nord, Greenland which would comprise a simple battery-operated tape recorder and sensors for measurement of a temperature, pressure, wind speed and direction, is reviewed. The operation of the UGO instrumentation is described and experience with the station is discussed. Future improvements are outlined. ESA

N76-28776 World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL AND TECHNICAL PROBLEMS IN OPERATING AUTOMATIC WEATHER STATIONS (AFMS) IN THE METEOROLOGICAL SERVICE OF THE GERMAN DEMOCRATIC REPUBLIC

S. Klemm *In its* Automated Meteorol. Systems 1975 p 254-259 refs (For availability see N76-28743 19-47)

Copyright.

Plans for the reorganization of the weather station network of the GDR Meteorological Service are discussed and will include the introduction of automatic weather stations (AFMS). The four different categories of stations are described. The state of the art of the AFMS is reviewed together with an analysis of problems which have been solved in the course of development. Unsolved problems are also briefly noted. ESA

N76-28777 World Meteorological Organization, Geneva (Switzerland).

A NEW ION DISPLACEMENT SYSTEM TO MEASURE THE TWO DIMENSIONAL WIND VECTOR

J. A. Waletzko *In its* Automated Meteorol. Systems 1975 p 260-269 refs (For availability see N76-28743 19-47)

Copyright.

In the Thermo-Systems Ionflo products a corona discharge is used to produce positive air ions and inject them into the wind. The air whose velocity is to be measured is made to flow through the gap between the corona anode and cathode in a direction perpendicular to the electric field. A unique method of collecting the ions allows the wind velocity to be determined without a direct determination of either the ion displacement or transit time. The basic theory of operation is outlined and the instrument, which operates as a mass flow meter, is described. Typical performance data are given and indicate the system has a high accuracy, dynamic range and frequency response. ESA

N76-28778 World Meteorological Organization, Geneva (Switzerland).

MARS: THE CANADIAN AUTOMATED METEOROLOGICAL STATION

J. S. Dickson and C. E. Robinson *In its* Automated Meteorol. Systems 1975 p 270-276 (For availability see N76-28743 19-47)

Copyright.

The general philosophy behind the development of the Canadian Meteorological Automatic Reporting Stations (MARS-II) is outlined followed by a general description of MARS-II. Each station is polled sequentially on an hourly reporting interval by a central computer facility. The station responds by transmitting data in a fixed format relating to cloud history, visibility, wind speed, precipitation and other parameters. The interface techniques between the sensors and the station are outlined together with details of peripherals and related equipment. ESA

N76-28779 World Meteorological Organization, Geneva (Switzerland).

NCAR AUTOMATED ENVIRONMENTAL CHAMBER

D. B. Call and H. W. Baynton *In its* Automated Meteorol. Systems 1975 p 277-282 (For availability see N76-28743 19-47)

Copyright.

The NCAR Automated Environmental Chamber which provides a cube-shaped space on a side in which pressure, temperature and dew point can be precisely and automatically controlled is described. A minicomputer gives digital control of the five processes that regulate chamber parameters, four of which are

fluid flow. The sensors are briefly described and the software package and its operation discussed. System performance and control accuracy are also summarized. ESA

N76-28780 World Meteorological Organization, Geneva (Switzerland).
MESOSCALE DATA GATHERING, PROCESSING AND DISTRIBUTION IN THE NATIONAL HAIL RESEARCH EXPERIMENT
F. E. Robitaille and T. R. Nicholas *In its* Automated Meteorol. Systems 1975 p 283-291 (For availability see N76-28743 19-47)
Copyright.

Since 1971 the National Hail Research Experiment has operated precipitation, mesometeorological and upper-air networks in northeastern Colorado. Each of the networks is described including network management and instrumentation, instrument calibration, maintenance and servicing. Techniques for rapid and efficient data flow, quality control and reduction to working form are detailed. Data distribution methods are described and a brief outlook regarding a planned, computerized, integrated data system is presented. ESA

N76-28781 World Meteorological Organization, Geneva (Switzerland).
INVESTIGATION OF METEOROLOGICAL SENSORS TO MAXIMIZE DATA QUALITY OF NDBO (NOAA DATA BUOY OFFICE) BUOY SYSTEMS
John F. Holmes *In its* Automated Meteorol. Systems 1975 p 292-301 refs (For availability see N76-28743 19-47)
Copyright.

To demonstrate methods of research and testing necessary to obtain quality data at the sensor level, four specific error sources for buoy sensors are identified, two each for the barometric and air temperature measurements respectively. Some tentative solutions for eliminating these problems are given. These involve procedural changes, additional equipment or engineering redesign. ESA

N76-28782 World Meteorological Organization, Geneva (Switzerland).
FIELD TESTING FOR SELECTION AND DEVELOPMENT OF HIGH RELIABILITY SENSORS **c35**
A. D. Stewart, D. J. McKay, and T. Hacking *In its* Automated Meteorol. Systems 1975 p 302-309 refs (For availability see N76-28743 19-47)
Copyright.

The reasons behind field testing are advanced and a methodology of development testing described. The basis of the testing is comparison and methods of automating the process of reducing the sensor outputs to a common denominator for correlation are briefly discussed. To illustrate the process of selection and development testing for automatic weather station sensors, examples of cloud height detectors, solar radiation shields and humidity sensor tests are given. The results of tests using the sensors are presented and discussed. ESA

N76-28783 Meteorological Research Inst., Tokyo (Japan).
AUTOMATIC WEATHER STATION AS A DATA COLLECTION PLATFORM OF THE GEOSTATIONARY METEOROLOGICAL SATELLITE SYSTEM
N. Kodaira, N. Murayama, Y. Takayama, and E. Kamishiro *In* WMO Automated Meteorol. Systems 1975 p 310-315 ref (For availability see N76-28743 19-47)
Copyright.

The two main types of data collection platform are distinguished and a fully automatic weather station for land use is described. The design philosophies of the system are followed by a discussion of the meteorological parameters to be measured and the instruments to measure them. Brief details concerning the power source and radio set are also given. ESA

N76-28784 World Meteorological Organization, Geneva (Switzerland).
A DRIFTING BUOY SYSTEM FOR USE WITH NIMBUS F
K. J. T. Sands and R. R. Dickson *In its* Automated Meteorol. Systems 1975 p 316-322 refs (For availability see N76-28743 19-47)
Copyright.

As part of a program to develop techniques for the measurement of meteorological variables in a marine environment, six buoys will be deployed in the N.E. Atlantic soon after the launch of Nimbus F which will locate and accept data transmitted by them. The experimental program is reviewed and the buoys and their sensors are described. ESA

N76-28785 World Meteorological Organization, Geneva (Switzerland).
AUTOMATED METEOROLOGICAL DATA ACQUISITION SYSTEM (AMEDAS)
Naosuke Arizumi *In its* Automated Meteorol. Systems 1975 p 323-329 (For availability see N76-28743 19-47)
Copyright.

The development of the Automated Meteorological Data Acquisition System (AMEDAS) in Japan and its telemetering and linkage with 1310 weather stations is traced. A description of the station facilities and functions and equipment for observation is given together with a review of the facilities of the computer center and the data processing functions. ESA

N76-28786 World Meteorological Organization, Geneva (Switzerland).
AUTOMATING THE HYDROLOGIC REPORTING NETWORK
J. W. Schiesl *In its* Automated Meteorol. Systems 1975 p 330-340 refs (For availability see N76-28743 19-47)
Copyright.

The existing river and rainfall reporting network in the U.S.A. is described in terms of the size, operation and equipment. Advances in sensing and communication technology have led to the automation of hydrological networks, and one, AHOS (Automatic Hydrologic Observing System) is described. Other NWS automated systems such as AMOS, RAMOS, AFOS and ADAS are also reviewed. A plan for the improvement of the hydrologic reporting network is considered and system implementation is reported. ESA

N76-28787 World Meteorological Organization, Geneva (Switzerland).
PORTABLE AUTOMATED MESONET (PAM)
F. V. Brock *In its* Automated Meteorol. Systems 1975 p 341-350 (For availability see N76-28743 19-47)
Copyright.

The Portable Automatic Mesonet (PAM) is a system comprised of a trailer-mounted base station and a network of remote stations for logging mesoscale data such as sea breezes, hail storms, air pollution and squall lines. The base and remote station functions are given and the system accuracy and resolution discussed. A preliminary performance survey following the data path from sensors to final logged data at both types of station is presented. ESA

N76-28788 World Meteorological Organization, Geneva (Switzerland).
FOREST FIRE METEOROLOGY RESEARCH NETWORK
M. H. McCutchan *In its* Automated Meteorol. Systems 1975 p 351-359 refs (For availability see N76-28743 19-47)
Copyright.

An automated forest fire telemetry network that has been installed in the San Bernadino Mountains of Southern California to collect data on wind velocity, temperature, and relative humidity in mountainous terrain from a chain of meteorological stations is described. The placement of stations is considered and their instrumentation is described. Accuracy and reliability of the network is discussed and research applications of the data gathered by the network are listed. ESA

N76-28789 World Meteorological Organization, Geneva (Switzerland).
CODE CONVERSION OF AUTOMATIC WEATHER STATION REPORTS BY A REAL-TIME COMPUTER
D. G. Peterson and E. S. Hughes *In its* Automated Meteorol. Systems 1975 p 360-368 refs (For availability see N76-28743 19-47)
Copyright.

A central computer system to process messages from

Canadian automatic weather stations before they are reported to the user is described. The design objectives for the code conversion computer system are outlined in detail together with an overview of the Interdata 7/16 minicomputers which handle the routines. The automatic station network and telecommunication protocol is briefly noted followed by examples of the sensor and station reporting formats and parameters. Methods to calculate parameters not directly measured by the system are given. Experience to the end of 1974 using the system is presented together with a brief review of future plans. ESA

N76-28790 World Meteorological Organization, Geneva (Switzerland).
SOME DESIGN ASPECTS OF SENSOR AND ELECTRONIC SYSTEMS FOR SEA BUOYS
E. E. Jesson and R. J. McKenzie *In its* Automated Meteorol. Systems 1975 p 369-374 (For availability see N76-28743 19-47)
Copyright.

Solutions to two problems relating to the reliability of buoys used for meteorological purposes are discussed. The problems are the conservation of the dry-battery power supply and the ventilation of an atmospheric pressure transducer to the atmosphere. Since the buoy data would be recovered by satellite via radio telemetry near mid-day a light detection system coupled with an internal clock enabled the radio power supply to be switched on for two hours either side of mid-day thus achieving a power saving of 83%. In order to restrict entry of water into the buoy via the vent tube coupling the pressure transducer to the atmosphere, a series of baffles in the tube were used. ESA

N76-28791 World Meteorological Organization, Geneva (Switzerland).
THE PROVISION OF LONG-PERIOD UNATTENDED CLIMATOLOGICAL STATIONS FOR USE IN REMOTE AREAS OF AUSTRALIA
E. E. Jesson *In its* Automated Meteorol. Systems 1975 p 375-380 (For availability see N76-28743 19-47)
Copyright.

The weather station requirements in Australia are reviewed and the reasons for the selection of magnetic tape recorders are outlined. The majority of the stations are for rainfall recording and an evaluation of different types of magnetic tape digital event recorders was made based on certain criteria. The need for data translation and compression is discussed together with other related data handling problems. ESA

N76-28792# Battelle Pacific Northwest Labs., Richland, Wash.
INVESTIGATION OF REGIONAL FLOW PATTERNS FOR IMPROVING ESTIMATES OF EFFLUENT TRANSPORT AND DIFFUSION
D. L. Elliott, W. F. Sandusky, and R. K. Woodruff Sep. 1975 24 p refs Presented at the Ann. Meeting of Pacific Northwest Intern. Sect. Pollution Control Assoc., Vancouver, British Columbia
(Contract E(45-1)-1830)
(BNWL-SA-5347; Conf-751138-1) Avail: NTIS HC $4.00

Regional wind flow patterns and transport in the lower wind recording stations over the Mid-Columbia region of Washington and Oregon. Spatial and temporal variability in the computed wind fields were analyzed from hourly data during November 1974 over a study area of 170 by 190 km. Much of the surface variability in flow appears to be due to topographical effects. From an investigation of the non-frontal situations, there is evidence that regional flow types could be classified, to some extent, by surface pressure patterns. Based on this study, long-term or regional transport based entirely on 850 mb flow could be in serious error. Techniques for improving estimates of regional transport, through the adoption and modification of an existing model and the utilization of regional data are examined. Applications of these techniques to various facets, i.e., environmental impacts from potential industrial and nuclear development, are discussed. Author (ERA)

N76-28793# Nebraska Univ., Lincoln. Agricultural Meteorology Section.
GREAT PLAINS EVAPOTRANSPIRATION BY A RESISTANCE MODEL USING REMOTELY SENSED THERMAL IMAGERY Progress Report
Norman J. Rosenberg, Blaine L. Blad, Shashi B. Verma, and Maximo W. Baradas Dec. 1975 165 p refs Sponsored in part by Kansas Agricultural Experimental Station, Manhattan, Kansas
(Contract DI-14-31-0001-4146)
(PB-250454/6; PR-75-3; OWRT-B-028-NEB(1); W76-05179) Avail: NTIS HC $6.75 CSCL 02D

The objectives of the project conducted in cooperation with the Kansas State University Evapotranspiration Laboratory were: (1) to test the utility of a resistance model for estimating evapotranspiration rates over large areas; (2) to determine the feasibility of obtaining ground and crop temperature data by remote sensing with infrared thermometry and the accuracy achievable by these means; and (3) to quantify the boundary layer resistance to diffusion as a function of crop height, crop roughness, and wind speed. Resistance models were tested in an extensive set of experiments conducted at Manhattan, Kansas using soybeans and sorghum; Mead, Nebraska using sorghum; and Scottsbluff, Nebraska using millet. GRA

N76-28794# National Oceanic and Atmospheric Administration, Research Triangle Park, N. C. Air Resources Lab.
FISCAL YEAR 1974 SUMMARY REPORT OF NOAA METEOROLOGY LABORATORY SUPPORT TO THE ENVIRONMENTAL PROTECTION AGENCY
Herbert J. Viebrock Nov. 1975 87 p refs Sponsored in part by EPA, Research Triangle Park, N. C.
(PB-250967/7; NOAA-TM-ERL-ARL-53; NOAA-76021005) Avail: NTIS HC $5.00 CSCL 04A

Research and operational meteorological support provided to the Environmental Protection Agency (EPA) is described. Operational support included the review of the meteorological aspects of environmental impact statements, requests for variances, implementation plans, and grant and contract proposals; the application of dispersion models; and the preparation of dispersion studies and evaluations. Research support was in the areas of model development and application, climatic analysis and atmospheric effects of pollutants, and the high surface ozone problem. GRA

N76-28795# National Severe Storms Lab., Norman, Okla.
THUNDERSTORM-OUTFLOW KINEMATICS AND DYNAMICS
R. Craig Goff Dec. 1975 72 p refs
(PB-250808/3; NOAA-TM-ERL-NSSL-75; NOAA-76020401) Avail: NTIS HC $4.50 CSCL 04B

Data collected from twenty cases of cold air outflow from thunderstorms during 1971 through 1974 are presented. The data were collected by tall tower and conventional radar sensors at the National Severe Storms Laboratory. The data were objectively analyzed, each case plotted in 10 min, 450 m deep time-height sections and the cases arranged in an evolutionary sequence based on outflow and storm intensity criteria. Four stages of cold air outflow were established and variations in outflow character are discussed in terms of these stages. Most outflow observations were associated with solid or broken lines; two parent thunderstorms were of the supercell type, and two others were left-moving cells following a thunderstorm split. GRA

N76-28796# National Weather Service, Garden City, N.Y.
USE OF RADAR INFORMATION IN DETERMINING FLASH FLOOD POTENTIAL
Stanley E. Wasserman Dec. 1975 15 p refs
(PB-250071/8; NOAA-TM-NWS-ER-60; NOAA-76010201) Avail: NTIS HC $3.50 CSCL 04B

A systematic method is described in which manual digital radar values are used with flash flood guidance to help isolate areas where there is a flash flood potential. Radar estimates of maximum precipitation are compared objectively with the minimum, three-hour precipitation amounts required for flash flooding. Through this comparison, areas that have a potential for flash flooding are determined. Flash Flood Guidance is the minimum rainfall required for flash flooding. Using the three latest manually digitized radar (MDR) observations, a three-step procedure is presented for monitoring flash flood potential. GRA

N76-28797# Meteorology Research, Inc., Altadena, Calif.
EVALUATION OF AIRBORNE RAINDROP SIZE-DISTRIBUTIONS MEASUREMENTS FOR IMPROVING RADAR RAINFALL ESTIMATES Final Report
T. B. Smith, D. M. Takeuchi, R. L. Peace, and S. M. Howard 21 Feb. 1975 407 p refs
(Contract DI-14-06-D-7536)
(PB-250012/2; MRI-75-FR-1294) Avail: NTIS HC $11.00 CSCL 04B

An experiment was performed to evaluate the potential contribution of airborne measurements and/or surface raingages, for improving the accuracy and reliability of radar measurements of rainfall for evaluation of weather modification experiments. The aircraft was equipped with a precipitation spectrometer probe, a metrodata rain rate meter, and an hydrometeor sampler for measurements of raindrop size distributions. The accuracy of the airborne measurements was evaluated.
Author (GRA)

N76-28798# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 14811/14813 LANCE, MISSILE NOS. 2608/2609, ROUND NOS. 263 APT/264 APT (21 MAY 1975) Meteorological Data Report
May 1975 42 p
(DA Proj. 1T6-65702-D-1)
(AD-A020491; DR-888) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14811/14813 Lance, Missile Numbers 2608/2609, Round numbers 263 APT/264 APT, are presented in tabular form.
GRA

N76-28799# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 03702 HONEST JOHN MISSILE NO. 1505, ROUND NO. 646 AML
6 Oct. 1975 19 p
(DA Proj. 1T6-65702-D-127)
(AD-A020499; DR-894) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 03702 Honest John, Missile number 1505, Round number 646 AML, are presented in tabular form.
GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-28800 Oregon State Univ., Corvallis.
PREDICTION OF BREAKER TYPE AND MEASUREMENT OF SURF-BORES ON AN OCEAN BEACH Ph.D. Thesis
Michael Kenneth Gaughan 1976 90 p
Avail: Univ. Microfilms Order No. 76-14389

This study applies to the theory of wave propagation in water of gradually varying depth, as developed by Biesel (1952), to determine the dependence of spilling and plunging breaker types on the beach slope tangent s and on the deep water wave steepness. The impetus for the study is that the dissipation of energy and the transfer of momentum by the waves to the nearshore water significantly depends on the breaker-type. By representing the fluid motion at the surface in Lagrangian coordinates, a graph is developed for the breaker type based on 21 combinations of s and height/length of deep water. A comparison with laboratory wave data shows good agreement with this graph based entirely on theory. The steepening of the shoaling wave profile on the shoreward wave face leads to the occurrence of a vertical surface, a natural breaking criterion.
Dissert. Abstr.

N76-28801*# Marine Technology Society, Washington, D.C.
PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON APPLICATIONS OF MARINE GEODESY
1974 464 p refs Symp. held at Columbus, Ohio, 3-5 June 1976
(Contract NASw-2645)
(NASA-CR-148458) Avail: NTIS HC $12.00 CSCL 08E

An analytical framework for dealing with the economic aspects of marine geodesy is presented. A hypothetical market for the information provided by marine geodesy is constructed to examine how this market might work without government intervention. The rationale for government participation in the provision of information about the ocean is discussed.
B.B.

N76-28802# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Seafloor Engineering.
BACKGROUND PAPERS ON SEAFLOOR ENGINEERING VOLUME 1: NATIONAL NEEDS IN SEAFLOOR ENGINEERING
Ronald L. Geer, Raymond Kaufman, Adrian F. Richards, Robert C. Bostrom, and J. B. McAleer 1975 368 p refs 2 Vol.
(Contract NSF C-310)
(PB-249110/8) Avail: NTIS HC $10.50; HC also available in set of 2 reports as PB-249109-SET, HC $19.00 CSCL 13J

National needs, current capabilities, and engineering research requirements for the offshore petroleum industry, the offshore mining industry, artificial islands and platforms are summarized. Perspective of technology for deepwater ports in the U.S.A., the national needs and capabilities in ocean energy systems, and the potential and limitations of the marine disposal of waste material are reviewed. National security needs are also reviewed.
GRA

N76-28803# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Seafloor Engineering.
BACKGROUND PAPERS ON SEAFLOOR ENGINEERING. VOLUME 2: STATE-OF-THE-ART IN SEAFLOOR ENGINEERING
Adrian F. Richards, Shun C. Ling, and Ben C. Cerwick, Jr. Jun. 1975 300 p refs 2 Vol.
(Contract NSF C-310)
(PB-249111/6) Avail: NTIS HC $9.25; HC also available in set of 2 reports as PB-249109-SET, HC $19.00 CSCL 13J

Current capabilities and national needs in seafloor engineering and related activities are evaluated. Engineering research needed to advance the state-of-the-art in seafloor engineering is identified. Procedures for government, industry, and university cooperation to facilitate the implementation of specific research programs are recommended.
GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-28804 California Univ., Berkeley.
ENZYMES IN HETEROGENEOUS SYSTEMS Ph.D. Thesis
Alan James Benesi 1975 165 p
Avail: Univ. Microfilms Order No. 76-15110

Investigations involving enzymes in heterogeneous systems were undertaken: (1) experiments in which papain activity was used as a microenvironmental redox meter demonstrated that the redox potential in the vicinity of a charged interface can be significantly different than that of the bulk solution when the redox agents bear unlike charges; (2) a theoretical mathematical treatment of residence times of molecules in columns was used to demonstrate that the phenomenon of convective dispersion increases the average residence time of molecules in a column; (3) a simple experimental investigation of the dependence of apparent soil enzyme activity on soil particle size clearly demonstrated that diffusion can limit observed soil enzyme reaction rates; and (4) experiments with a mitochondrial membrane enzyme malate dehydrogenase revealed that nonionic detergent micelles double observed first-order reaction rates (and lower the affinity constant by a factor of 2).
Dissert. Abstr.

N76-28805 Arizona Univ., Tucson.
THE SYNTHESIS OF SPECIFICALLY DEUTERATED AMINO ACIDS AND PERTIDES FOR USE IN BIOPHYSICAL STUDIES Ph.D. Thesis
Donald Allen Upson 1975 126 p
Avail: Univ. Microfilms Order No. 76-14547

The synthesis is reported of specifically deuterated S-benzyl cysteine derivatives deuterated in the alpha position only, the

beta position only, and in the alpha and beta positions simultaneously. These compounds were used to introduce specifically deuterated cysteine into the neurohypophyseal hormones oxytocin and [8-arginine] vasopressin at the 1-hemi- or the 6-hemi-cystine positions. Also reported is the synthesis of alpha deuterated isoleucine and its inclusion into the 3 position of oxytocin. In addition to the deuterated hemi-cystine derivatives of [8-arginine] vasopressin, alpha deuterated phenylalanine was synthesized and incorporated into the 3 position of this peptide hormone. Within the framework of the above syntheses, several methodological questions of peptide and amino acid synthesis were studied.
Dissert. Abstr.

N76-28806 Rochester Univ., N.Y.
NONLINEAR DIFFUSION MODELS AND SPATIAL INTERACTIONS IN BIOLOGICAL SYSTEMS Ph.D. Thesis
Ronald Morris Shymko 1976 167 p
Avail: Univ. Microfilms Order No. 76-14787

The effects of spatial structure on the qualitative dynamics of nonlinear biological systems are studied. Nonlinearly coupled diffusion equations are set up in order to take into account the spatial transport of the active components, and the possible modes of behavior are determined. Changes in the qualitative behavior (bifurcations) are found to occur as the spatial parameters such as size or shape are varied. Topics considered include: (1) a two-component coupled chemical system with spatially localized (heterogeneous) catalysts; (2) a mathematical model for the control of tissue growth by a diffusible mitotic inhibitor; and (3) a dynamical model for vision which incorporates the nonlinearities and lateral interactions known to exist in the visual system.
Dissert. Abstr.

N76-28807*# Agence Tunisienne de Public-Relations, Tunis.
NATURAL HISTORY OF AGARICINES
M. V. Fayod Washington NASA Jul. 1976 290 p refs Transl. into ENGLISH from Ann. Sci. Natur., Bot. Biol. Veg. (France), vol. 7, no. 9, May. 1888 p 181-411
(Contract NSF C-504)
(NASA-TT-F-16514) Avail: NTIS HC $9.25 CSCL 06C

A Class of fungi, the Basidiomycetes, was studied (specifically, the Order Agaricales, which includes all forms of fleshy gilled mushrooms). Topics discussed include: (1) biological classification, (2) the morphology of fungal structures such as mycelium, sclerotial bodies, spores, stipes, gills, and pileus, and (3) reproductive cycles. Reference is made, where applicable, to the works of De Bary and other mycologists. A brief review of the natural groups of Agaricaceae is given. Also discussed are methods of collection and preservation for these fungi. J.R.T.

N76-28808*# Boeing Co., Houston, Tex.
TWO TECHNIQUES FOR ELIMINATING LUMINOL INTERFERENCE MATERIAL AND FLOW SYSTEM CONFIGURATIONS FOR LUMINOL AND FIREFLY LUCIFERASE SYSTEMS Quarterly Report, Jan. - Mar. 1976
Richard R. Thomas Jan. 1976 18 p refs
(Contract NAS5-22545)
(NASA-CR-144768) Avail: NTIS HC $3.50 CSCL 06C

Two methods for eliminating luminol interference materials are described. One method eliminates interference from organic material by pre-reacting a sample with dilute hydrogen peroxide. The reaction rate resolution method for eliminating inorganic forms of interference is also described. The combination of the two methods makes the luminol system more specific for bacteria. Flow system designs for both the firefly luciferase and luminol bacteria detection systems are described. The firefly luciferase flow system incorporating nitric acid extraction and optimal dilutions has a functional sensitivity of 3 x 100,000 E. coli/ml. The luminol flow system incorporates the hydrogen peroxide pretreatment and the reaction rate resolution techniques for eliminating interference. The functional sensitivity of the luminol flow system is 1 x 10,000 E. coli/ml. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-28809 Kansas Univ., Lawrence.
RECOVERY DURING RADIATION AND CHEMICAL MUTAGENESIS Ph.D. Thesis
Dennis Frank Deen 1975 213 p
Avail: Univ. Microfilms Order No. 76-16714

These investigations were directed toward the study of recovery in radiation and chemical mutagenesis in cultured mammalian cells. A mutagenesis system was established in which mutation of V79-171b Chinese hamster cells to 8-azaguanine resistance was tested. The effects of split dose and postirradiation treatments upon both X-ray and EMS induced mutagenesis were determined. Observations and conclusions are presented.
Dissert. Abstr.

N76-28810 Utah Univ., Salt Lake City.
DIAGNOSTIC APPLICATION OF MICROWAVE RADIATION Ph.D. Thesis
Peder Christian Pedersen 1976 178 p
Avail: Univ. Microfilms Order No. 76-16574

The feasibility of applying low intensity microwave radiation in the diagnosis and monitoring of pathological pulmonary conditions such as pulmonary edema and emphysema is considered. The significant change in total lung water which is a characteristic of pulmonary edema and emphysema modifies the permittivity and conductivity of the lung tissue. Both the reflection technique and the transmission technique have been investigated with single frequency and swept frequency measurements. With the single frequency reflection technique, dynamic events such as respiration or cardiac rhythm have been measured, and animal experiments have indicated that this technique is applicable for monitoring of the progress of pulmonary edema. Using the swept frequency transmission technique, the transmission coefficient was measured on a phantom model of the chest. Changing the 'lung' water content of the phatom model produced significant changes in the transmission coefficient later confirmed by theoretical calculations. Dissert. Abstr.

N76-28811 Texas Univ., Austin.
THE MEASUREMENT OF THRESHOLD TEMPERATURES IN THE OCULAR FUNDUS FOR LASER INDUCED, VISIBLE LESIONS Ph.D. Thesis
Leslie Alexander Priebe 1975 209 p
Avail: Univ. Microfilms Order No. 76-14505

Measurements of temperature increases resulting from exposures to argon laser irradiations were made in the eyes of living rhesus monkeys with 10-20 micrometers thermocouples. Using the appearance of an ophthalmoscopically visible lesion as the criterion for damage, the temperature associated with the appearance of a threshold lesion 5 minutes post exposure was determined. Temperature increases at the center of the lesion and at the radial extent of the lesion were determined from radial scans of the thermocouple through the laser image and from ophthalmoscope measurements of the lesion radius.
Dissert. Abstr.

N76-28812 Utah Univ., Salt Lake City.
LONG-WAVELENGTH ANALYSIS OF ELECTROMAGNETIC POWER ABSORPTION BY PROLATE SPHERODIAL AND ELLIPSOIDAL MODELS OF MAN Ph.D. Thesis
Habibollah Massoudi 1976 217 p
Avail: Univ. Microfilms Order no. 76-15572

An electromagnetic (EM) field perturbation technique is used to obtain the induced fields and the associated power deposition in both prolate spheroidal and ellipsoidal models of man and experimental animals being irradiated by an EM plane wave when the wavelength is long compared to the major axis of the spheroid or ellipsoid. Calculations of the power absorbed by both spheroidal and ellipsoidal models of man and animals are given for different frequencies and orientations of the models with respect to the incident field vectors. The effects of tissue anisotropy on power absorption in planar and spherical models are also investigated. The results show that marked differences in tissue absorbed power can occur due to tissue anisotropy at frequencies below 10 MHz. The quantitative data resulting from this study are valuable for estimating tissue EM power absorption in experimental animals and man. Dissert. Abstr.

N76-28813*# Joint Publications Research Service, Arlington, Va.
EFFECTS OF ABRUPT TIME ZONE CHANGE ON SOME CIRCADIAN RHYTHMS IN MAN
N. I. Moiseyeva Washington NASA Jul. 1976 10 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 61, no. 12, Dec. 1975 p 1798-1804
(NASA Order W-13183)
(NASA-TT-F-17117) Avail: NTIS HC $3.50 CSCL 06P

Changes have been demonstrated in circadian rhythm indices of the cardiovascular system in essentially healthy individuals, in the course of transmeridional flights, particularly when crossing over 9 time zones. The nature of the changes depends on the direction of the flight. After flying to the east, the reactions appear immediately: decreased duration of sleep, arterial pressure drops, and there is leveling off of daily fluctuations of cardiovascular system indices. After flying to the west, the changes begin on the 2d day: shorter duration of sleep, change in sleep pattern, increased range of changes in EEG frequencies, altered fluctuations of tonus of the cardiovascular system. The sleep rhythm disturbances associated with flights in both directions disappear in about 1 week; the cardiovascular system changes disappear in 2 weeks after flying west and in over 1 month after flying east. Intake of soporifics during the flight accelerates the process of adaptation to new time zones. Author

N76-28814*# Kanner (Leo) Associates, Redwood City, Calif.
DRUG/RECEPTOR INTERACTIONS: THE EXAMPLE OF THE CARDIAC GLYCOSIDE RECEPTOR OF THE ERYTHROCYTE MEMBRANE
Erland Erdmann Washington NASA Aug. 1976 17 p refs Transl. into ENGLISH from Blut. (West Ger.), vol. 32, no. 2, 1976 p 61-70
(Contract NASw-2790)
(NASA-TT-F-17151) Avail: NTIS HC $3.50 CSCL 06E

An example of an analysis of a drug/receptor interaction is described. According to this analysis the receptor for cardiac glycosides is on the outside of the erythrocyte membrane and is located on a protein which spans the membrane. This protein is believed to be (Na(+) + K(+))-ATPase. Author

N76-28815# Little (Arthur D.), Inc., Cambridge, Mass.
CURRENT AWARENESS SERVICE FOR TOXIC SUBSTANCES (CATS). CUMULATIVE REPORT NO. 1, PART 1
Dec. 1975 500 p refs
(Contract EPA-68-01-2694)
(PB-250074/2; EPA-560/7-75-003-1; ADL-C-77355-Pt-1) Avail: NTIS HC $12.50; HC also available in set of 2 reports as PB-250073-SET, HC $24.00 CSCL 06T

The two part cumulative report contains 26 current awareness documents prepared biweekly from 26 August 1974 through 11 August 1975, during the first year of a two year project. The purpose of this project was to provide the Office of Toxic Substances (OTS), U.S. Environmental Protection Agency with information on new uses of existing chemical products and with information of obvious potential environmental concern for both new and existing chemical products. For each biweekly document a core list of approximately 80 journals was scanned for information of interest to OTS on more than 30 topics (compounds, classes of compounds, and subject areas, e.g., model ecosystems). Abstracts were prepared for all items selected and these abstracts were presented biweekly under the assigned topics. In addition, a 'General Information' section was added to accommodate abstracts for topics not included in the original list of scanning topics. GRA

N76-28816# Little (Arthur D.), Inc., Cambridge, Mass.
CURRENT AWARENESS SERVICE FOR TOXIC SUBSTANCES (CATS). CUMULATIVE REPORT NO. 1, PART 2
Dec. 1975 507 p refs
(Contract EPA-68-01-2694)
(PB-250075-9; EPA-560/7-75/003-2; ADL-C-77355-Pt-2) Avail: NTIS HC $12.75; HC also available in set of 2 reports as PB-250073-SET, HC $24.00 CSCL 06T

For abstract, see part 1.

N76-28817# National Inst. for Occupational Safety and Health, Rockville, Md.
CRITERIA FOR A RECOMMENDED STANDARD. OCCUPATIONAL EXPOSURE TO CARBON TETRACHLORIDE
Dec. 1975 155 p refs
(PB-250424/9; NIOSH-TR-76-133) Avail: NTIS HC $6.75 CSCL 06J

Recommended standards for safe exposure levels to chemical hazards found in the workplace are presented. It is recommended that occupational exposure shall be controlled so that workers are not exposed to carbon tetrachloride in excess of 2 ppm (12.6 mg/cu m) determined as a timeweighted average (TWA) exposure for up to a 10-hour workday, 40-hour workweek. Recommendations on environmental exposure, medical, labeling, sampling and analysis, personal protection, informing employees of the hazard, work practices and monitoring and record keeping are included. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-28818 Illinois Univ., Urbana.
TOWARD A RESPIRATOR CONTROL SYSTEM Ph.D. Thesis
John Peter Schill 1976 142 p
Avail: Univ. Microfilms Order No. 76-16189

The physiology of a patient who requires a respirator is deranged in a sufficiently unique manner as to make a general complex modeling impractical. A basic approach is taken emphasizing the gas exchange function of the human respiratory system and the maintenance of this exchange through proper use of pulmonary mechanics. A model that is amenable to application control theory is developed and justified. Optimal control theory is applied to the dynamic equations of the model to yield design equations (control laws) of a controller. Several different formulations of the control problem are considered and comparisons made. Specifically, the continuous formulation of the control problem for both time optimal and quadratic performance indexes, sampled-data formulation for both time optimal and quadratic performance indexes, and the continuous time optimal maximum principle formulation are considered.
Dissert. Abstr.

N76-28819*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
INTEGRATION OF VISUAL AND MOTION CUES FOR SIMULATOR REQUIREMENTS AND RIDE QUALITY INVESTIGATION Semiannual Status Report, Dec. 1975 - Jun. 1976
Laurence R. Young Jun. 1976 164 p refs
(Grant NGR-22-009-701)
(NASA-CR-148479) Avail: NTIS HC $6.75 CSCL 08H

Practical tools which can extend the state of the art of moving base flight simulation for research and training are developed. Main approaches to this research effort include: (1) application of the vestibular model for perception of orientation based on motion cues: optimum simulator motion controls; and (2) visual cues in landing. Author

N76-28820*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
MONITORING SPACECRAFT ATMOSPHERE CONTAMI-

NANTS BY LASER ABSORPTION SPECTROSCOPY Final Technical Report, 1 Jan. 1974 - 31 Aug. 1976
J. I. Steinfeld 31 Aug. 1976 124 p refs
(Grant NGR-22-009-766)
(NASA-CR-148481) Avail: NTIS HC $5.50 CSCL 06K

Laser-based spectrophotometric methods which have been proposed for the detection of trace concentrations of gaseous contaminants include Raman backscattering (LIDAR) and passive radiometry (LOPAIR). Remote sensing techniques using laser spectrometry are presented and in particular a simple long-path laser absorption method (LOLA), which is capable of resolving complex mixtures of closely related trace contaminants at ppm levels is discussed. A number of species were selected for study which are representative of those most likely to accumulate in closed environments, such as submarines or long-duration manned space flights. Computer programs were developed which will permit a real-time analysis of the monitored atmosphere. Estimates of the dynamic range of this monitoring technique for various system configurations, and comparison with other methods of analysis, are given. Author

N76-28821# Civil Aeromedical Inst., Oklahoma City, Okla.
EARPLUG RANKINGS BASED ON THE PROTECTOR-ATTENUATION RATING (P-AR)
Jerry V. Tobias Oct. 1975 62 p refs
(AD-A024756/9; FAA-AM-75-11) Avail: NTIS HC $4.50 CSCL 06/17

Forty-five attenuation spectra for earplugs were classified according to a simplified method designed to produce single number ratings of noise reduction. The rating procedure was applied to the mean attenuation scores, to mean-minus-one-standard-deviation scores, and to mean-minus-two-standard-deviations scores. The reporting of all three numbers seems to give the fairest indication of an earplug's value in controlling hearing damage in noise-exposed populations. The tests are described and ranked. Author

N76-28822# Systems Technology, Inc., Hawthorne, Calif.
A MODEL FOR HUMAN PILOT BEHAVIOR DURING WAKE VORTEX ENCOUNTER UPSETS Final Report, Jun. 1974 - Dec. 1975
Walter A. Johnson and Thomas T. Myers Apr. 1976 38 p refs
(Contract DOT-FA73WA-3276)
(AD-A024534/0; TR-1035-5; FAA-RD-76-8) Avail: NTIS HC $4.00 CSCL 06/19

A model for pilot behavior is needed to more completely analyze the consequences (including hazard assessment) of wake vortex encounter upsets during final approach. Such a model was developed to describe a pilot's roll control behavior during a vortex upset. This model resulted from abstracting the salient characteristics of the many vortex encounters recorded during two moving-base piloted simulations at NASA Ames Research Center. The model allows for several discrete modes of behavior and includes an associated set of switching logics. The model is the result of a lengthy sequence of analytical steps. A description of the resulting model and several example applications are presented. Author

N76-28823# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
DEVELOPMENT OF TWO NEW OXYGEN SELF-RESCUERS
R. L. Stein Jan. 1976 32 p refs
(PB-250809/1; BM-RI-8102) Avail: NTIS HC $4.00 CSCL 06K

The new oxygen self-rescuers are designed to be carried by a miner while he is at work and are used during emergency escape. These devices supply high-purity oxygen to the user and, at the same time, absorb CO2. One of the new self-rescue breathing units is a 10-minute self-contained apparatus. Its size and weight are comparable to the currently used self-rescue devices. The second device is a 4.5 lb package that supplies one hour of oxygen to the miner. Both devices have a canister that contains the oxygen-producing and CO2-absorbing potassium superoxide chemical, a breathing bag, a bite-type mouthpiece, noseclip, goggles, and hoses connecting the canister and mouthpiece. GRA

N76-28824# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.
EVALUATION OF SELF-CONTAINED ANTHROPOMORPHIC DUMMY DATA ACQUISITION SYSTEM Final Report, 1 Oct. - 31 Dec. 1975
E. Enserink Feb. 1976 143 p
(Contract DOT-HS-6-01295)
(PB-250722/6; DOT-HS-801-827; Rept-3961-75-178) Avail: NTIS HC $6.00 CSCL 14B

The test program evaluated a self contained solid state digital data acquisition system mounted in a 50th percentile male anthropomorphic dummy. Five automobile crash tests of various types were conducted with the crash recorder-equipped dummy occupying different seating positions in each test and restrained by either conventional belts or an air cushion restraint system. Following each test the data were extracted from the self contained recorder and transcribed onto a magnetic tape for further processing and the computation of dummy injury criteria.
Author (GRA)

N76-28825# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
PERSONAL HEARING PROTECTIVE DEVICES, FITTING, CARE, AND USE
Doug Ohlin Jan. 1975 54 p refs
(AD-A021408) Avail: NTIS CSCL 06/17

The technical guide gives guidance for the establishment of occupational hearing conservation programs and information deemed useful for personnel having the responsibility for fitting and issuing hearing protective devices. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N76-28826 Missouri Univ., Rolla.
A MATHEMATICAL INVESTIGATION OF THE EFFECTS OF COMPUTER ARCHITECTURAL FEATURES ON PROGRAM SIZE Ph.D. Thesis
James Frederick Wade 1975 106 p
Avail: Univ. Microfilms Order No. 76-14618

The effect is studied of four types of computer architectural features on the length of a program when program symbols are encoded with a minimum redundancy code. Entropy is used to approximate the average length of a code symbol. The features studied are intended to reduce program length by utilizing anomalies in the distributions of symbols. Mathematical models of the features are developed and expressions are solved for the conditions which determine if a program size will be reduced

by the introduction of the feature. A rule of thumb for limiting conditions of large program segment size and small probabilities of occurrence of features which depend on probability anomalies is determined: the structure or pattern of symbols to be taken advantage of must occur about e (natural log base) times as often as it would be expected to occur randomly before it can be used to reduce the size of a program. Dissert. Abstr.

N76-28827 Illinois Univ., Urbana.
AN ARRAY COMPUTER FOR THE CLASS OF PROBLEMS TYPIFIED BY THE GENERAL CIRCULATION MODEL OF THE ATMOSPHERE Ph.D. Thesis
Martin Lowell Graham 1976 299 p
Avail: Univ. Microfilms Order No. 76-16137

A computer suited to the class of problems typified by the general circulation model of the atmosphere was designed. Constraints on the design which was sought specified that the new machine have roughly 100 times the computing capability of the IBM 360/95 which is now used in general circulation model research. Of equal importance, the cost of the machine was to be significantly less than that of extant machines with similar computing capability. The design which is presented is that of an array processor similar in architecture to ILLIAC IV. The design is in terms of commercially available TTL and ECL small and medium scale integrated circuits. Dissert. Abstr.

N76-28828 California Univ., Berkeley.
STORAGE STRUCTURES FOR RELATIONAL DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
Gerald David Held 1975 126 p
Avail: Univ. Microfilms Order No. 76-15211

Storage structures are examined which allow efficient access to information in a relational data base management system. The major areas investigated are: (1) storage structures for data relations, (2) storage structures for auxiliary information to speed access to data, and (3) a strategy for selecting structures based on query statistics. A generalized directory structure is defined and is shown to provide better performance than either normal directories or simple order preserving functions. Secondary indexes on functions of attributes are introduced and a method for reusing aggregation information is presented. A general strategy for making storage structure choices is presented. The query model is extended to provide more accurate choice of key domains. The strategy selects data relation storage structures, primary key domains, and auxiliary structures. Dissert. Abstr.

N76-28829 California Univ., Berkeley.
GRAPHICS MODELING TECHNIQUES IN COMPUTER AIDED DESIGN Ph.D. Thesis
Harvard Hathaway Holmes 1975 197 p
Avail: Univ. Microfilms Order No. 76-15223

Past efforts at computer aided design have been hampered by an approach which combined the man-machine problem description interface with the problem analysis portion of the system. A methodology which separates these two aspects of computer aided design is presented. By recognizing those topological properties of schematic diagrams that are common to a wide variety of disciplines, GMS is able to provide a single man-machine problem description interface for use in a wide variety of problem solving disciplines. In addition, GMS includes intermediate data structures, and preprocessing facilities that form a natural interface and starting point for the creation of additional analysis capabilities are described. Dissert. Abstr.

N76-28830 Illinois Univ., Urbana.
THEORETICAL LIMITATIONS ON THE USE OF PARALLEL MEMORIES Ph.D. Thesis
Henry David Shapiro 1976 109 p
Avail: Univ. Microfilms Order No. 76-16195

Regardless of the underlying machine architecture, independently addressable memory modules contribute significantly to program speed-ups on modern computers. Because of memory conflicts which arise while accessing data, actual program speed-ups are generally less than theoretically possible. Several geometric and algebric conditions are presented which determine if the data of a computation can be organized to avoid memory conflicts. It is shown that a prime number of memory modules gives height memory utilization and allows the use of simpler storage schemes than a power of two number of memory modules. The case of greatest practical significance, reference to rows, columns, and diagonals of a matrix, is given special attention. Finally, a brief discussion is presented which relates this research to the construction of memory-processor connections networks for single-instruction-multiple-data stream machines. Dissert. Abstr.

N76-28831 California Univ., Berkeley.
EFFICIENT RETRIEVAL IN RELATIONAL DATA BASE SYSTEMS Ph.D. Thesis
Robert Mark Pecherer 1975 90 p
Avail: Univ. Microfilms Order No. 76-15335

For a conventional digital computer and a simple, uniform storage representation for relations, a variety of techniques are presented for performing these evaluations efficiently. A subset of four operators is shown to provide sufficient relation-defining capability to be considered as a retrieval language. The efficient evaluation of all expressions over these operators and any fixed set of data base relations is explored. Algorithms for the application of each operator are provided whose running times are asymptotically as good or better than previously known solutions. In addition, conditions are described for achieving further speed-up for two of the operators. Procedures for each of the four operators permit the evaluation of any such algebraic expression through recursive application of operators to data base relations and the intermediate results of the computation. A correspondence is established between an expression and a class of iterative procedures which evaluate the expression without the use of intermediate relations. Algorithms are given to select that procedure whose running time is minimal or expected minimal within any class. Dissert. Abstr.

N76-28832 California Univ., Berkeley.
CUPID: A GRAPHICS ORIENTED FACILITY FOR SUPPORT OF NON-PROGRAMMER INTERACTIONS WITH A DATA BASE Ph.D. Thesis
Nancy Harriet McDonald 1975 178 p
Avail: Univ. Microfilms Order No. 76-15298

CUPID (Casual User Pictorial Interface Design) is a facility designed to support non programmer interactions with a data base system. It is a front-end user interface for the relational data base system, INGRES, and compiles 'pictures' into the query language, QUEL supported by INGRES. CUPID's data sublanguage and its definition capability are discussed. The data sublanguage is complete, high level and picture oriented, depending almost entirely on 'menumove' operations on a CRT terminal. Hence, users have no need to type extensive English text and difficult natural language processing can be completely avoided. The feasibility of a picture query language is analyzed and the working implementation and design for extension of the system is described. In conjunction with the prototype implementation, a human factors experiment was designed and conducted to compare the CUPID system to the more formal language, QUEL. This experiment is described and the results discussed. Dissert. Abstr.

N76-28833 California Univ., Los Angeles.
DESIGN CONSIDERATIONS FOR LARGE COMPUTER COMMUNICATION NETWORKS Ph.D. Thesis
Farouk Kamon 1976 407 p
Avail: Univ. Microfilms Order No. 76-15942

The specification, analysis, and evaluation of some routing and topology design procedures for large store and forward packet switched computer communication networks are presented. The procedures studied are an extension of present techniques and rely on a hierarchical clustering of the network nodes. Hierarchical adaptive routing schemes, optimal clustering structures, queueing models, and buffer sharing schemes are among the topics discussed. A hierarchical design methodology is presented as a solution for the reduction of the computational cost involved in the topological design of large networks. Dissert. Abstr.

N76-28834*# Bell-Northern Research Ltd., Ottawa (Ontario).
A 128K-BIT CCD BUFFER MEMORY SYSTEM Final Report, 20 Aug. 1974 - 6 Feb. 1976
K. H. Siemens, R. W. Wallace, and C. R. Robinson Jul. 1976 166 p refs

(Contract NAS1-13507)
(NASA-CR-145020) Avail: NTIS HC $6.75 CSCL 09B

A prototype system was implemented to demonstrate that CCD's can be applied advantageously to the problem of low power digital storage and particularly to the problem of interfacing widely varying data rates. 8K-bit CCD shift register memories were used to construct a feasibility model 128K-bit buffer memory system. Peak power dissipation during a data transfer is less than 7 W., while idle power is approximately 5.4 W. The system features automatic data input synchronization with the recirculating CCD memory block start address. Descriptions are provided of both the buffer memory system and a custom tester that was used to exercise the memory. The testing procedures and testing results are discussed. Suggestions are provided for further development with regards to the utilization of advanced versions of CCD memory devices to both simplified and expanded memory system applications. Author

N76-28835*# Institute for the Future, Menlo Park, Calif.
COMPUTER-BASED COMMUNICATION IN SUPPORT OF SCIENTIFIC AND TECHNICAL WORK Final Report
Jacques Vallee and Thaddeus Wilson Mar. 1976 68 p
(Contract NAS2-8991)
(NASA-CR-137879) Avail: NTIS HC $4.50 CSCL 09B

Results are reported of the first experiments for a computer conference management information system at the National Aeronautics and Space Administration. Between August 1975 and March 1976, two NASA projects with geographically separated participants (NASA scientists) used the PLANET computer conferencing system for portions of their work. The first project was a technology assessment of future transportation systems. The second project involved experiments with the Communication Technology Satellite. As part of this project, pre- and postlaunch operations were discussed in a computer conference. These conferences also provided the context for an analysis of the cost of computer conferencing. In particular, six cost components were identified: (1) terminal equipment, (2) communication with a network port, (3) network connection, (4) computer utilization, (5) data storage and (6) administrative overhead. Author

N76-28836# Oak Ridge National Lab., Tenn.
DISK/DECTAPE MONITOR FOR THE TD8E
P. R. Bell, R. S. Dillon, and B. E. Beasley Oct. 1975 33 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5079) Avail: NTIS HC $4.00

An efficient and convenient monitor system to be used with the low cost tape unit was developed by modifying the existing monitor system and several programs. The system will operate in 7 PDP 8/E computer, will support two tape drives, and can load and save programs from all available memory. The operation is the same as in the usual tape system. Author (ERA)

N76-28837# California Univ., Livermore. Lawrence Livermore Lab.
MICROPROCESSOR AS A COMPUTER MAINFRAME
R. W. Conn Oct. 1975 7 p refs Presented at the 9th Ann. Asilomar Conf. on Circuits, Systems and Computers, Pacific Grove, Calif., 3-5 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77443; Conf-751109-7) Avail: NTIS HC $4.50

Some performance characteristics of microprocessors are briefly compared with other machines in order to establish their suitability as CPU's for a broad class of interactive problems. An appropriate architecture for a single-user machine is presented along with user-oriented software based on a general-purpose macroprocessor. Author (ERA)

N76-28838# California Univ., Livermore. Lawrence Livermore Lab.
STRUCTURAL-ANALYSIS MOVIE POSTPROCESSOR (SAMPP), USER'S MANUAL
B. E. Brown 7 Oct. 1975 49 p refs
(Contract W-7405-eng-48)
(UCID-30097-Rev-1) Avail: NTIS HC $5.00

SAMPP is a general routine for the display of three-dimensional, finite-element models and the results of both static and dynamic analysis. The postprocessor may be used to produce line drawings and continuous tone pictures, as well as animated-line-drawing movie sequences. The SAMPP uses a hidden-surface processor for the display of realistic perspective views. SAMPP is written in FORTRAN and is compiled, loaded, and run on the CDC 7600 computers of the Livermore time-sharing system. Author (ERA)

N76-28839# New York Univ., N.Y. Div. of Applied Science.
AUTOMATIC DATA PROCESSING TECHNIQUES FOR GRAPHIC-DATA DISPLAY, GENERATION AND ANALYSIS Final Scientific Report, 1 Sep. 1974 - 31 Aug. 1975
Herbert Freeman 31 Oct. 1975 18 p refs
(Grant AF-AFOSR-2755-75; AF Proj. 9769)
(AD-A020664) Avail: NTIS CSCL 09/2

This final Scientific Report provides summary of the accomplishments of the research concerned with two major problems in computer image processing: (1) the extraction of clean line-drawing outlines of three-dimensional objects from photographs in which these objects are partially obscured by shadows, haze and glare, and (2) the reconstruction of complete three-dimensional descriptions of solid objects from multiple photographs taken from different vantage points and under different lighting conditions. GRA

N76-28840# Wisconsin Univ., Madison. Mathematics Research Center.
THE AUGMENT PRECOMPILER 2. TECHNICAL DOCUMENTATION
F. D. Crary Oct. 1975 142 p refs
(Contract DAAG29-75-C-0024)
(AD-A020198; MRC-TSR-1470) Avail: NTIS CSCL 09/2

AUGMENT allows the FORTRAN programmer to easily use packages implementing nonstandard data types and operations. This report describes the internal structure and logic of AUGMENT. User documentation is contained in a previous report. GRA

N76-28841# Naval Surface Weapons Center, White Oak, Md.
PROGRESS TOWARD THE CROSSTIE MEMORY 3 Technical Report, Oct. 1974 - Oct. 1975
L. J. Schwee, H. R. Irons, W. E. Anderson, R. S. Sery, and O. J. VanSant, Jr. 1 Oct. 1975 38 p refs
(MAT Proj. 03L-000; ZF61512001)
(AD-A020926; NSWC/WOL/TR-75-167) Avail: NTIS CSCL 09/2

This is the third annual technical report of progress toward the crosstie memory and emphasizes the work done during the past year. In the crosstie memory, information is stored in magnetic domain walls rather than domains and domain wall motion is not used in its operation. The basic building block of the crosstie memory is a magnetic shift register which depends on Bloch line motion rather than domain wall motion. The crosstie memory is intended for use as a block oriented random access memory (BORAM) or fast auxiliary memory (FAM). The advantages of the crosstie memory are speed, low power, high bit density, nonvolatility, a wide temperature range of operation, low cost, and use of available technology. There were two major accomplishments this past year. One is the magnetoresistance detector, the second is the serrated track which simplifies propagation, detection, and fabrication. Present problem areas and approaches to their solution are discussed. Plans and design goals are also presented. GRA

N76-28842# Mitre Corp., Bedford, Mass.
SECURE COMPUTER SYSTEM: UNIFIED EXPOSITION AND MULTICS INTERPRETATION
D. E. Bell and L. J. LaPadula Jan. 1976 132 p refs
(Contract F19628-75-C-0001; AF Proj. 522B)
(AD-A020445; MTR-2997; ESD-TR-75-306) Avail: NTIS CSCL 09/2

A unified narrative exposition of the ESD/MITRE computer security model is presented. A suggestive interpretation of the model in the context of Multics and a discussion of several other important topics (such as communications paths, sabotage and integrity) conclude the report. A full, formal presentation of the model is included in the Appendix. GRA

N76-28843# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PARSING INTENSITY PROFILES
Tomas Lozano-Perez May 1975 27 p refs
(Contract N00014-75-C-0643)
(AD-A021172; AI-M-329) Avail: NTIS CSCL 09/2

Much low-level vision work in (artificial intelligence) deals with one-dimensional intensity profiles. This paper describes PROPAR, a system that allows a convenient and uniform mechanism for recognizing such profiles. PROPAR is a modified Augmented Transition Networks parser. The grammar used by the parser serves to describe and label the set of acceptable profiles. The input to the parser are descriptions of segments of a piecewise linear approximation to an intensity profile. A sample grammar is presented and the results discussed. Author (GRA)

N76-28844# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
INTERACTIVE COMPUTER GRAPHICS Annual Report, 1 Jan. - 31 Dec. 1975
Andries VanDam 1 Jan. 1976 9 p refs
(Contract N00014-75-C-0427; Grant NSF GJ-41539)
(AD-A020181) Avail: NTIS CSCL 09/2

The goal of this research in distributed computing is to evolve fundamental concepts as well as implementation techniques for improving system performance by judicious runtime distribution of functions to processors and to levels of a hierarchical operating system. This distribution of computing tasks among the various processors in a network or among the many levels of a hierarchical operating system in a single computer is a critical issue in current and future military, industrial, and educational computer systems. The present approach is to provide the applications programmer with tools that allow both the estimation of performance improvements of potential migrations, either horizontal (inter-processor) or vertical (intra-processor), and the implementation of the most promising migrations. GRA

N76-28845# Illinois Univ., Urbana. Coordinated Science Lab.
DESIGN OF FAIL-SAFE ASYNCHRONOUS SEQUENTIAL MACHINES
Yu-Dar Fan Jan. 1976 88 p refs
(Contract DAAB07-72-C-0259)
(AD-A020136; R-713; UILU-ENG-76-2201) Avail: NTIS CSCL 09/2

Fail-safe designs are commonly classified as 0-fail-safe or 1-fail-safe designs, where the indicated binary signal is considered the 'safe' value and is produced in case of failures, and N-fail-safe designs, where both of the signals 0 and 1 are considered reliable and a distinct third symbol, N, is produced in case of failures in the circuit. Two methods for the fail-safe design of asynchronous sequential machines are presented in this paper: in the first method, ordinary binary logic elements are used in the realization. Signals are duplicated to guarantee the safe value of the output in the 0-fail-safe or 1-fail-safe case, and a new state assignment method is used in the N-fail-safe case. In the second method, complete sets of 'fail-safe logic elements' are designed first and then assembled into fail-safe realizations. For the N-fail-safe case, two approaches are discussed: one uses three-valued logic, the other uses a binary encoding. The appropriate checking circuits are also designed so that faults are indicated before the capabilities of the designs are exceeded. GRA

N76-28846# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
DYNAMIC MODEL FOR DISTRIBUTED DATA-BASES Final Report
Katriel Dan Levin and Howard Lee Morgan Apr. 1975 31 p refs
(Contract N00014-75-C-0462)
(AD-A020650; Rept-75-04-01) Avail: NTIS CSCL 09/2

A multi-period model of programs and data file assignment in computer networks is presented. In reality, access request patterns are subject to change over time, thus, an optimal file assignment at one period is no longer optimal in the next period. An optimizing procedure for the assignment of programs and data files over time is suggested. This procedure takes into account both the dependencies between programs and data file and the transition costs incurred by file movements from one assignment at a given period to another assignment at the next period. Author (GRA)

N76-28847# University of Southern Calif., Marina del Rey. Information Sciences Inst.
PROTECTION ERRORS IN OPERATING SYSTEMS: INCONSISTENCY OF A SINGLE DATA VALUE OVER TIME
Richard Bisbey, II, Gerald Popek, and Jim Carlstedt Dec. 1975 18 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A020481; ISI/SR-75-4) Avail: NTIS CSCL 09/2

This report describes a pattern-based approach for finding a general class of computer operating system errors characterized by the inconsistency of a data value between pairs of references. A formal description of the error class is given, both as a protection policy being enforced and as a violation of that policy, i.e., an error statement. A particular subclass of the general error class is then examined, i.e., those errors in which the data type is a parameter. A formal specification of a procedure for finding instances of the subclass is given with examples of errors found using the procedure. This work has been performed under Advanced Research Projects Agency Contract DAHC15 72 C 0308. It is part of a larger effort to provide securable operating systems in DOD environments. Author (GRA)

N76-28848# Georgia Univ., Athens. Dept. of Statistics and Computer Science.
AN INTERACTIVE WORKSHEET SYSTEM FOR STATISTICAL USAGE
Stephen F. Bingham and Rolf E. Bargmann Aug. 1975 299 p refs
(Contract N00014-69-A-0423; NR Proj. 042-261)
(AD-A020515; TR-106) Avail: NTIS CSCL 09/2

This report discusses the implementation of an interactive version of the National Bureau of Standard's OMNITAB system. This version has been adopted to work under a Graphics Monitor System on an IBM 2250 terminal, connected to an IBM 360 or 370 central processor. Several routines have been added or adapted which make the system especially useful for statistical applications, and as an instructional tool. The immediate availability of displays of sections of the worksheet, after each instruction is the central feature of this adaptation. Several examples of statistical applications are included in this report. Author (GRA)

N76-28849# Army Electronics Command, Fort Monmouth, N.J. Communications/Automatic Data Processing Lab.
DPM/MPL (BURROUGHS DATA PROCESSOR MODULE/ MODIFIED PROGRAMMERS LANGUAGE) COMPILER MANUAL Final Report
Martin I. Wolfe and Mark B. Schwartz Nov. 1975 85 p refs
(AD-A020538; ECOM-4373) Avail: NTIS CSCL 09/2

Modified Programmers Language (MPL), a programming language similar to XPL, has been implemented for the Burroughs Data Processor Module (DPM). The DPM/MPL compiler is described and illustrated, including the parsing and reducing algorithms, syntactic and semantic stacks, code buffer, storage allocation scheme, and procedures. The semantic routines of the compiler that deal with the MPL language features are also explained. A listing of the compiler in source code is provided. GRA

N76-28850# Stanford Univ., Calif. Electronics Labs.
HIGH PERFORMANCE EMULATION
Walter A. Wallach, Jr. Nov. 1975 19 p refs
(Grant AF-AFOSR-2865-75; AF Proj. 9769)
(AD-A020665; SU-SEL-75-047; AFOSR-76-0131TR) Avail: NTIS CSCL 09/2

The Stanford EMMY is examined as an emulation engine. Using the 360 emulator and the DELtran interpreter as examples, the performance of the current EMMY architecture is examined as a high performance emulation vehicle. The problems of using a sequential, vertically organized processor for high speed emulation are developed and discussed. A flexible control structure for high speed emulation studies is derived from an existing high performance processor. This structure issues a stream of microinstructions to a central command bus, allowing user-defined execution resources to execute them in overlapped fashion.

These execution resources may be added or deleted with little or no processor rewiring. Author (GRA)

N76-28851# Ohio State Univ., Columbus. Computer and Information Science Research Center.
THE ARCHITECTURAL DESIGN OF A SECURE DATA BASE MANAGEMENT SYSTEM Ph.D. Thesis
Richard Irwin Baum Nov. 1975 294 p refs
(Contract N00014-75-C-0573)
(AD-A021158; OSU-CISRC-TR-75-8) Avail: NTIS CSCL 09/2

In recent years computers have become increasingly central to the functioning of organized society. One of their most critical tasks has been the storage and processing of large amounts of data. These systems go by many names: computer data bank, management information systems, command and control system -- just to name a few. All of these systems have one thing in common: a large data base that may be accessed by multiple users. The need to share this information is obvious: maintaining a separate copy of the data for each user would be totally impractical due to its cost and complexity. As data bases become larger and proliferate throughout industry and government we will see a steady growth in the amount of sensitive information stored in computer systems. If we expect to allow sharing of a data base, we must provide a secure system to prevent misuse of data. Unless a user is assured that his sensitive data is protected from unauthorized access, he will not allow it to be stored in the system. Sharing of these data bases will increase markedly as networking develops. Furthermore, many societies will not tolerate violation of a citizen's privacy because of non-secured data bases. Governments may soon impose legal restrictions on the contents of data bases that are inadequately secured. GRA

N76-28755 World Meteorological Organization, Geneva (Switzerland).
THE MICROCOMPUTER IN METEOROLOGICAL INSTRUMENTATION
J. M. Pike and F. V. Brock *In its* Automated Meteorol. Systems 1975 p 79-84 refs (For availability see N76-28743 19-47)
Copyright.

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-28852 Yale Univ., New Haven, Conn.
PROGRAM CONSTRUCTION FROM EXAMPLES Ph.D. Thesis
Phillip Dale Summers 1975 90 p
Avail: Univ. Microfilms Order No. 76-14563

An automatic programming system, THESYS, for constructing recursive LISP programs from examples of what they do is described. Programs are specified by a finite set of examples. Each example consists of an input and the desired output. The program construction system is described in terms of a set of algorithms that define a series of transformations from the set of examples to a program satisfying the examples. The program generation methodology is based on current theories of programming and program language semantics. Theoretical models of data and control structures are presented in proving the validity of some of the synthesis algorithms. The system includes algorithms for (1) deriving the specific computation associated with a specific example, (2) deriving control flow predicates and (3) deriving an equivalent program specification in the form of recurrence relations. Dissert. Abstr.

N76-28853 North Carolina State Univ., Raleigh.
AN EMPIRICAL INVESTIGATION OF ESTIMATION OF COMPUTATIONAL EFFORT FOR A BRANCH-AND-BOUND ALGORITHM Ph.D. Thesis
Richard James Coppins 1975 148 p
Avail: Univ. Microfilms Order No. 76-14315

The development of three different approaches for predicting the time required to complete a branch-and-bound algorithm, or alternately to classify a problem as easy or hard, is reported. The methods used can be categorized as combinatorial, stochastic, and statistical. An extended combinatorial approach was developed and tested on a set of random binary knapsack problems. A stochastic model was developed, which led to a different measure of effort. This technique was also tested on the same set of random problems. Statistical descriptor variables were developed and utilized in statistical techniques (regression and discriminant analysis) and a pattern recognition technique (the nearest neighbor algorithm). The approaches were tested on the set of random test problems. The combinatorial, discriminant analysis, and nearest neighbor approaches were found to be effective.
Dissert. Abstr.

N76-28854 Georgia Inst. of Tech., Atlanta.
THE PRIMARY LOGICS OF PROGRAMMING LANGUAGES Ph.D. Thesis
Robert Ian Winner 1975 113 p
Avail: Univ. Microfilms Order No. 76-15601

In computer programming and computing, a paradigm case is often found in the planning and execution of plans. These plans and their executions are successful or fail in much the same way that assertions are true or false. It was demonstrated that the methods of logical assessment of assertoric reasoning can be applied fruitfully to the assessment of programmatic reasoning and in particular to problems of correctness and equivalence of programs. The history of logical assessment, the relationship between logistic analysis and the broader semiotic analysis, and the notion of programmatic reasoning, valuations, and inferences are discussed. A family of programming languages, PL and a subfamily thereof called I sub 1 are presented. Studies on the morphology, theory, and semantics of the families were performed. The semantics are of two forms, one based on models, the other on valuations. Also included are several metalogical results about the theory of I sub 1 including completeness, soundness, and consistency. Several directions for additional study including further specification of I sub 1 and another possible type of programming language, I sub 2 are given. Dissert. Abstr.

N76-28855 Oregon Univ., Eugene.
A PRELIMINARY ANALYSIS OF COMPONENT SKILLS IN INTRODUCTORY FORTRAN PROGRAMMING Ph.D. Thesis
Jackson Michael Dunlap 1975 129 p
Avail: Univ. Microfilms Order No. 76-15033

A preliminary statistical analysis was conducted to determine the relationship between a test based upon the matrix defined in this study and standard measures used to evaluate students in FORTRAN programming courses. The results demonstrated positive relationships between tests based upon the derived skills and standard measures of success. Dissert. Abstr.

N76-28856 California Univ., Berkeley.
PQ-TREE ALGORITHMS Ph.D. Thesis
Kellogg Speed Booth 1975 166 p
Avail: Univ. Microfilms Order No. 76-15117

PQ-trees can be used to implement linear-time algorithms which test a graph for either the property of being an interval graph or the property of being a planar graph. The interval graph test is based on a theorem of Fulkerson and Gross which defines the consecutive ones properly for matrices. The planarity test implements an algorithm of Lempel, Even, and Cederbaum. Using the techniques developed here, both tests can be performed in a number of steps which is proportional to the size of the graph being tested. A representation of PQ-trees as formulas is provided by the class of PQ-formulas. It is shown that PQ-formulas form a lattice under two fairly natural operations, both related to the idea of grouping various parts of a formula into consecutive substrings. A special case of the lattice meet operation is called reduction. Dissert. Abstr.

N76-28857 Missouri Univ., Rolla.
A BLOCKED ORTHOGONALIZATION METHOD FOR NON-LINEAR REGRESSION Ph.D. Thesis
Daniel Clay St.Clair 1975 172 p
Avail: Univ. Microfilms Order No. 76-14617

The blocked orthogonalization algorithm for nonlinear regression is developed from a study of matching problems having certain identifiable characteristics with algorithms which exploit

those characteristics. The new algorithm represents an extension of an earlier algorithm by using a blocked orthogonalization technique. The result is a generalization of the algorithms which maintains the desirable properties of the algorithms while avoiding their more serious limitations. The new algorithm was found to be quite effective for solving problems in which the parameters in the model under consideration were naturally grouped. Numerous criteria for evaluating algorithm performance are used to compare results of the new algorithm with those of the Davidon-Fletcher-Powell, Levenbert-Marquardt, Gauss-Hartley, and Grey algorithms. Dissert. Abstr.

N76-28858 Colorado Univ., Boulder.
AN ALGORITHM FOR A PATTERN SENSITIVE DATA STORAGE SYSTEM Ph.D. Thesis
William John Weida 1975 179 p
Avail: Univ. Microfilms Order No. 76-11616

The purpose of this study was to develop an algorithm which would store and recall data from a relational data matrix with more than one relationship in each data column. The methodology was to investigate both the theoretical limits of data compression and the possible methods of introducing order into a set of data to aid in this compression. An algorithm based on these methods was then applied to actual data storage situations. The Pattern Sensitive Data Storage System (PSDSS) functions without a mutually exclusive descriptor state restriction. It relies instead on a modified matrix row numbering system and a method of data storage which allows the algorithm to accept most forms of hierarchical data. Base Characteristic Functions (BCFs) are calculated from the data matrix, and these BCFs allow the data to be compressed for storage. Dissert. Abstr.

N76-28859*# M&S Computing, Inc., Huntsville, Ala.
MASK ANALYSIS PROGRAM (MAP) REFERENCE MANUAL
C. L. Mitchell 23 Jun. 1976 165 p Revised Supersedes NASA-CR-144042 dated 21 Oct. 1975
(Contract NAS8-25621)
(NASA-CR-149924; Rept-75-0039-Rev-1; NASA-CR-144042) Avail: NTIS HC $6.75 CSCL 09B

A document intended to serve as a User's Manual and a Programmer's Manual for the Mask Analysis Program is presented. The first portion of the document is devoted to the user. It contains all of the information required to execute MAP. The remainder of the document describes the details of MAP software logic. Although the information in this portion is not required to run the program, it is recommended that every user review it to gain an appreciation for the program functions. Author

N76-28860*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
[COMPUTER PROGRAM FOR SINGLE INPUT-OUTPUT, SINGLE-LOOP FEEDBACK SYSTEMS] Final Report
30 Jun. 1976 85 p refs
(Grant NsG-1140)
(NASA-CR-148490) Avail: NTIS HC $5.00 CSCL 09B

Additional work is reported on a completely automatic computer program for the design of single input/output, single loop feedback systems with parameter uncertainly, to satisfy time domain bounds on the system response to step commands and disturbances. The inputs to the program are basically the specified time-domain response bounds, the form of the constrained plant transfer function and the ranges of the uncertain parameters of the plant. The program output consists of the transfer functions of the two free conpensation networks, in the form of the coefficients of the numerator and denominator polynomials, and the data on the prescribed bounds and the extremes actually obtained for the system response to commands and disturbances. Author

N76-28861*# Engineering Information Systems, Inc., San Jose, Calif.
SPAR REFERENCE MANUAL
W. D. Whetstone Apr. 1976 312 p refs
(Contracts NAS8-30536; NAS1-13977)
(NASA-CR-149943; EISI/A2200) Avail: NTIS HC $9.75 CSCL 09B

The functions and operating rules of the SPAR system, which is a group of computer programs used primarily to perform stress, buckling, and vibrational analyses of linear finite element systems, were given. The following subject areas were discussed: basic information, structure definition, format system matrix processors, utility programs, static solutions, stresses, sparse matrix eigensolver, dynamic response, graphics, and substructure processors. Author

N76-28862*# M&S Computing, Inc., Huntsville, Ala.
TPGITF USER'S MANUAL
E. R. Pitts 26 Jul. 1976 11 p
(Contract NAS8-31358)
(NASA-CR-149949; Rept-76-0025) Avail: NTIS HC $3.50 CSCL 09B

The primary purpose of TPG interface (TPGITF) software is to create test patterns, according to a mathematical model, for a real device. In order for the device actually to be tested or to be accurately simulated, a means is required to transform the TPGITF generated test into forms acceptable as input to logic test equipment or to a software logic simulator. The MACRODATA-200 Logic Test System and the LOGSIM logic simulator are the particular systems supported by the TPGITF software. A description is presented of the TPGITF software processor. It is assumed that the reader is familiar with the TPG, LOGSIM, and TOIL systems. Flow charts are given. Author

N76-28863*# M&S Computing, Inc., Huntsville, Ala. Electronics and Control Lab.
DJANAL USER'S MANUAL Final Report
E. R. Pitts 23 Jul. 1976 32 p
(Contract NAS8-31358)
(NASA-CR-149948; Rept-76-0023) Avail: NTIS HC $4.00 CSCL 09B

The DJANAL (DisJunct ANALyzer) Program provides a means for the LSI designer to format output from the Mask Analysis Program (MAP) for input to the FETLOG (FETSIM/LOGSIM) processor. This document presents a brief description of the operation of DJANAL and provides comprehensive instruction for its use. Author

N76-28864# Sandia Labs., Albuquerque, N.Mex.
QMESH MESH GENERATION PACKAGE
R. E. Jones 1975 14 p refs Presented at the Conf. on Software for Partial Differential Equations, Moffett Field, Calif. Sponsored by ERDA
(SAND-75-5884; Conf-751208-1) Avail: NTIS HC $4.50

A package of five programs centering around the highly flexible, powerful, two-dimensional mesh generation program QMESH is presented. Together, the five programs provide a tool for generation, bandwidth minimization, and display of meshes with Q4 or Q8 elements. The primary purpose of the package is generation of input for finite element analysis programs. Author (ERA)

N76-28865# Oak Ridge National Lab., Tenn.
PROGRAMMING PRACTICES AND COMPUTER CODE DEVELOPMENT
D. R. Vondy Dec. 1975 63 p
(Contract W-7405-eng-26)
(ORNL-TM-5065) Avail: NTIS HC $5.45

Recommendations are given to programmers developing computer codes. These are of special importance in effort on those codes which will be used at other installations and on other computers. Many of the code exchange problems are addressed. Certain local routines are described which perform special tasks, many of which are not possible within the scope of the FORTRAN Language. Author(ERA)

N76-28866# Oak Ridge National Lab., Tenn.
THREE COMPUTER CODES OF GENERAL USE IN X-RAY CRYSTALLOGRAPHY
H. L. Yakel Jan. 1976 157 p
(Contract W-7405-eng-26)
(ORNL-TM-5177) Avail: NTIS HC $7.75

The FORTRAN listings and sample problem inputs and outputs for three programs of general use in X-ray diffraction analyses are presented. The programs calculate and plot stereographic projections, Laue patterns, and Debye Scherrer patters for general

crystal systems and, in the case of the third, for known crystal structures. Author (ERA)

N76-28867# Danish Atomic Energy Commission, Risoe.
FORSC, A LANGUAGE FOR STRUCTURED CODING IN FORTRAN
K. SoeeHoejberg Nov. 1975 17 p
(RISO-M-1828) Avail: ERDA Depository Libraries, HC $3.50

FORSC, a FORTRAN structure coder, is an extension to FORTRAN, and is intended for use on PDP8 type computers. It consists of a set of instructions that can be used together with FORTRAN 4 statements to create a structured program. FORSC is intended as an aid in the standardization of programming techniques. The object program is translated to a homogeneous FORTRAN 4 program by means of a macro processor, 8BAL. FORSC produces comments which emphasize the structure of the FORTRAN program. A generalized IF instruction is proposed, which can be used in the same way as a CASE instruction. Other instructions included are WHILE, UNTIL, FOR and LOOP with exit. The current version of macro definitions is developed on and for a PDP8/I with 16 k core memory and OS/8 monitor system. This version allows nesting of any instruction with up to five levels of the same instruction type. Author (ERA)

N76-28868# California Univ., Livermore. Lawrence Livermore Lab.
TRIX AC: A SET OF GENERAL PURPOSE TEXT EDITING COMMANDS
A. Cecil, H. Moll, and J. Rinde 15 Oct. 1975 58 p
(Contract W-7405-eng-48)
(UCID-30040-ED-7) Avail: NTIS HC $5.50

This report describes all the commands in the AC dialect of the TRIX interactive interpreter. It is a convenient reference document for users already familiar with TRIX AC; however, new users should obtain a copy of the Utility Routine Summary Sheets, UR-003. ERA

N76-28869# California Univ., Livermore. Lawrence Livermore Lab.
SOFTWARE SECURITY IN NETWORKS
J. G. Fletcher 1975 18 p Sponsored by ERDA
(UCRL-76027) Avail: NTIS HC $3.50

Software security measures must control, limit, and in some cases prohibit the access of each resource to the other resources in the network. The restrictions should ensure that the computer system cannot be damaged or altered by any of its users, that the privacy of each user's resources is guaranteed, and that sensitive information is not released into an unprotected environment. Designers and programmers must specify the resources to be protected and select structures for conveniently representing access rights among those resources. They must use encryption where necessary, identify users and other resources external to the network, and consider security requirements at all points in the actual programming. ERA

N76-28870# Sandia Labs., Livermore, Calif.
MEDIA8: A PROGRAM TO READ PDP-8 DECTAPES ON A PDP-11
H. D. Jones Nov. 1975 20 p refs
(Contract AT(29-1)-789)
(SAND-75-8297) Avail: NTIS HC $4.50

MEDIA8 is a PDP-11 minicomputer program which reads data from a DECtape prepared on a PDP-8, does conversions of the data into a format compatible with the PDP-11, and then writes the converted data out to an RT-11 device or permanent file. The conversions allowed by the program include two kinds of character string conversions, integer and floating point number conversions (both for single precision and double precision numbers), and a straight no conversion conversion. The conversion routines are tied together by a simplified calling method that allows repeated conversion requests to be specified in an abbreviated form similar to the FORMAT statement in FORTRAN. The program is currently being used on SLL's media conversion minicomputer to enable users of PDP-8 minicomputers easy access to the CDC 6600 computer for data reduction problems. Author (ERA)

N76-28871# Stanford Univ., Calif. Electronics Lab.
A TALE OF THREE EMULATORS
Lee W. Hoevel and Walter A. Waliach, Jr. Nov. 1975 18 p refs
(Grant AF-AFOSR-2865-75; AF Proj. 9769)
(AD-A020653; SU-TR-98; SU-SEL-75-045; AFOSR-76-0132TR) Avail: NTIS CSCL 09/2

This is a preliminary report on the development of emulator code for the Stanford EMMY. Emulation is introduced on an interpretive computing technique. Various classes of emulation and their correlation to the image machine are presented. Functional and structural overview of three emulators for the Stanford EMMY are presented. These are IBM System/360; CRIL; and DELtran. Performance estimates are included for each of these systems. Author (GRA)

N76-28872# Army Electronics Command, Fort Monmouth, N.J.
MPL PROGRAMMER'S MANUAL Final Report
Martin I. Wolfe and Mark B. Schwartz Nov. 1975 43 p
(AD-A020456; ECOM-4371) Avail: NTIS CSCL 09/2

A Modified Programming Language (MPL) similar to XPL, has been implemented for an advanced Data Processor Module (DPM). The features of MPL are described and illustrated. Syntax of constructs in the language are shown in BNF. Declaration statements, data types, assignments operations, expressions, blocks, scope of variables, flow of control, procedures, I/O, and compiler options and statistics are explained. GRA

N76-28873# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
METHOD OF OPTIMIZATION OF A PERIODIC STEP WAVEFORM FOR MINIMIZATION OF TOTAL HARMONIC DISTORTION Report for May 1974 - Feb. 1975
Razi A. Kokan Jun. 1975 61 p
(AD-A020156; USAMERDC-2148) Avail: NTIS CSCL 09/2

A method of optimization of a function of n variables under a constraint is developed. This method is applied to the optimization of N step voltage heights and the step width X in degrees (all step widths are equal) of a periodic step waveform so that the total harmonic distortion is minimized. Numerical techniques are used, and iterative algorithms are developed and implemented by a computer program, written in FORTRAN IV, for the USAMERDC CDC 6600 computer. Step waveforms with 3, 4, and 5 steps have been optimized. The procedure and the results are summarized. GRA

N76-28874# Federal COBOL Compiler Testing Service, Washington, D.C.
INTERDATA 7/16 DDS ANS SUBSET COBOL RELEASE 1.15 Final Validation Summary Report
11 Feb. 1976 54 p
(AD-A020551; CCVS74-VSR115) Avail: NTIS CSCL 09/2

This Validation Summary Report (VSR) provides a consolidated summary of the results obtained from the validation of the subject compiler. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by Federal level module; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N76-28875# Aerospace Corp., El Segundo, Calif.
A NEW ASSURANCE TECHNOLOGY FOR COMPUTER SOFTWARE Interim Report, Jul. 1974 - Jun. 1975
D. J. Reifer 1 Sep. 1975 31 p refs
(Contract F04701-75-C-0076)
(AD-A020483; TR-0076(6112)-1; SAMSO-TR-75-238) Avail: NTIS CSCL 09/2

The high cost (both direct and indirect) and poor reliability of computer software have become subjects of major concern to members of the military and business communities. They recognize that computer software has become big business. Annual expenditures for software are excessive, and are expected to increase in the future. Yet, the current literature is filled with horror stories attributing large cost overruns and system failures directly to poor management policies and inadequate quality control procedures that are presently applied to software developments. Many software practitioners recognize these

problems exist and are now attempting to do something about them. The first steps they're taking in their attack on the problem are aimed at introducing sound management and engineering practices to the art of computer programming. Some of the combatants are drawing from their product-assurance experiance to develop a new assurance technology for computer software. The objective of this paper is to explain what this new assurance technology is all about. GRA

N76-28876# Georgia Univ., Athens. Dept. of Statistics and Computer Science.
COMPUTATIONAL ALGORITHMS AND MODULES FOR THE EVALUATION OF STATISTICAL DISTRIBUTION FUNCTIONS
Hubert Bouver and Rolf E. Bargmann Aug. 1975 233 p refs
(Contract N00014-69-A-0423; NR Proj. 042-261)
(AD-A020514; TR-110; THEMIS-UGA-36) Avail: NTIS CSCL 09/2

This report presents a comparison of numerical methods for the evaluation of standard statistical distribution functions with at least 10 significant digits of precision. Different series and continued fraction expansions were compared with the purpose of finding the most efficient techniques for different domains of the parameters of the Beta, Gamma, and normal distributions. Other techniques, including a Hermite expansion of exponents, a Wilson-Hilferty expansion, and asymptotic series of the Euler-McLaurin type were also investigated for extreme values of parameters. On the basis of time comparisons, the most efficient modules were combined into distribution packages. Further extensions to non-central distributions have been included in this package. Author (GRA)

N76-28877# Wisconsin Univ., Madison. Mathematics Research Center.
A COMPUTATIONAL STUDY OF ACTIVE SET STRATEGIES IN NONLINEAR PROGRAMMING WITH LINEAR CONSTRAINTS
Melanie L. Lenard Nov. 1975 31 p refs
(Contract DAAG29-75-C-0024)
(AD-A020202; MRC-TSR-1564) Avail: NTIS CSCL 12/2

An essential part of many iterative methods for linearly constrained nonlinear programming problems is a procedure for determining those inequality constraints which will be 'active' (that is, satisfied as equalities) at each iteration. The author discusses experiments in which he used several strategies for identifying active constraints in conjunction with two well-known algorithms for linearly constrained optimization. The results indicate that in most cases a strategy which keeps the number of constraints in the active set as small as possible is computationally most efficient. GRA

N76-28878# Illinois Univ., Urbana. Coordinated Science Lab.
DISCRETE-TIME DYNAMIC GAMES
Benjamin Franklin Gardner, Jr. Sep. 1975 75 p refs
(Contract DAAB07-72-C-0259; Grants AF-AFOSR-2570-73; NSF ENG-74-20091)
(AD-A020135; R-691; UILU-ENG-75-2226) Avail: NTIS CSCL 12/2

A dynamic game is a system in which there is more than one controller each trying to minimize a different cost functional. The players may or may not cooperate with one another or form groups of cooperative players. In a game it is no longer easy to say what an 'optimal' solution is. Each player must take into account the amount of information available, what the other players are doing, and what his objectives are in computing what his 'optimal' control-strategy will be. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N76-28879 California Univ., Berkeley.
OPTIMAL ADAPTIVE CONTROL WITH CRITERION THAT INCLUDES SENSITIVITY TO A PARAMETER OF THE PRIOR DISTRIBUTION Ph.D. Thesis
Anand Ramchandra Gokhale 1975 109 p
Avail: Univ. Microfilms Order No. 76-15192

A discrete-time parameter-adaptive control system with dynamics containing an additive random-noise term xi sub i and an unknown additive parameter mu. Observations of the state are noise-free. Using Bayes's law, mu is studied from the observations. The usual expected cost criterion plus lambda times the square of the partial derivative of an arbitrary function with respect to a parameter mu prime of the apriori density of the unknown mu. Problems of imprecise and insufficient information are considered. Since the value of mu prime influences the updated densities used to evaluate the usual criterion, the choice of the control policy (and the corresponding criterion value) depends on mu prime and is sensitive to the value assumed for mu prime. It is argued that this sensitivity is an undesirable characteristic and, in some cases, the reduction of this sensitivity may be just important as the minimization of the usual criterion. It is that this can achieved by an augmented criterion which selects the control that has the desired sensitivity characteristics and yet is not too costly in terms of the usual criterion. Dissert. Abstr.

N76-28880 California Univ., Los Angeles.
CONTROL BY MODEL ERROR ESTIMATION Ph.D. Thesis
Robert Eugene Skelton 1976 236 p
Avail: Univ. Microfilms Order No. 76-16665

The problem of model errors in linear system models was approached by augmenting the original system of equations with an 'error system' which is designed to approximate the effects of such model errors as external disturbances, truncated modes, and parameter errors. When state estimation techniques are applied to the assumed 'error system' and when the error system belongs to a class called the Sturm-Liouville equations (which generate orthogonal functions), the resulting estimator is labeled an 'orthogonal filter.' A special case of the Sturm-Liouville equations called the Chebyshev error system generates the Chebyshev polynomials, which provide a least squares fit to the measurement residual over a specified interval. The important selection of this 'observation window' is related to a property of the closed loop system called the characteristic time. As an illustration, a Chebyshev error system is developed for application to the Large Space Telescope (LST). Dissert. Abstr.

N76-28881 Oklahoma Univ., Norman.
A MICROCOMPUTER BASED SUBSTATION CONTROL SYSTEM Ph.D. Thesis.
Billy Don Russell, Jr. 1975 131 p
Avail: Univ. Microfilms Order No. 76-15823

Investigations are made to define the present state of the art of power substation automation. Present substation operating requirements are presented and analyzed in detail. Classical techniques of substation control and protection are investigated and needed improvements are specified. Previous attempts at substation automation through digital control are investigated. Existing and proposed supervisory control and data acquisition systems as well as digital relaying systems are analyzed. Evaluations of these systems show a lack of system integration and less than optimum reliability. A distribution of control between centralized and local substation computers is presented. Overall control system requirements are specified including substation stand alone capability for critical functions and remotely adaptable settings for protection equipment. Dissert. Abstr.

N76-28882 Cornell Univ., Ithaca, N.Y.
STABILIZATION OF DISTANT AND LOCAL POWER SYSTEM DISTURBANCES BY OPTIMIZED FIELD CONTROLLER Ph.D. Thesis

Howard Kirby McCue, Jr. 1975 593 p
Avail: Univ. Microfilms Order No. 76-15297

An improved closed-loop, supplementary field controller was designed for a particular synchronous generator located at Moss Landing. This controller is optimized with respect to distant and local three-phase faults. To insure physical realizability, the controller inputs are restricted to locally measurable signals. The design procedure used in this study can be broken into three major portions: development of the mathematical representation of the west coast power grid, as viewed from Moss Landing, units 6 and 7, computation of the open-loop, optimized supplementary field control for the machine of interest, and realization of the closed-loop controller. Dissert. Abstr.

N76-28883# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON THE RATE DISTORTION FUNCTIONS OF SPHERICALLY INVARIANT VECTORS AND SEQUENCES
Stamatis Cambanis and Hoi M. Leung (Oregon Univ.) 1976 19 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 9769)
(AD-A020998; AFOSR-76-0107TR) Avail: NTIS CSCL 09/4

The Shannon lower bound of the rate distortion function of spherically invariant random vectors and sequences is found and a condition for its tightness is given. Under this condition simple upper bounds are given valid over a certain range of distortions. GRA

N76-28884# Stanford Univ., Calif. Dept. of Computer Science.
INTERACTIVE GENERATION OF OBJECT MODELS WITH A MANIPULATOR
David D. Grossman and Russell H. Taylor Dec. 1975 35 p refs
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A020942; SU-STAN-CS-75-536; SU-AIM-274) Avail: NTIS CSCL 09/2

Manipulator programs in a high level language consist of manipulation procedures and object model declarations. As higher level languages are developed, the procedures will shrink while the declarations will grow. This trend makes it desirable to develop means for automating the generation of these declarations. A system is proposed which would permit users to specify certain object models interactively, using the manipulator itself as a measuring tool in three dimensions. A preliminary version of the system has been tested. GRA

N76-28885# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
ON VISUAL DETECTION OF LIGHT SOURCES
Shimon Ullman May 1975 22 p refs
(Contract N00014-75-C-0643)
(AD-A021136; AI-M-333) Avail: NTIS CSCL 09/2

The paper addresses the following problem: Given an array of light intensities obtained from some scene, find the light sources in the original scene. The following factors are discussed from the point of view of their relevance to light sources detection: The highest intensity in the scene, absolute intensity value, local and global contrast, comparison with the average intensity, and lightness computation. They are shown to be insufficient for explaining humans' ability to identify light sources in their visual field. Finally, a method for accomplishing the source detection task in the mondrian world is presented. GRA

N76-28886# Applied Systems Corp., Palo Alto, Calif.
A CERTAINTY EQUIVALENCE CONTROL WITH A NONLINEAR FILTER IN THE FEEDBACK LOOP Interim Report
D. L. Alspach 1975 10 p
(Contract F44620-75-C-0023; AF Proj. 9769)
(AD-A020658; AFOSR-76-0049TR) Avail: NTIS CSCL 12/1

The problem of control of a linear stochastic system observed by both linear and hard limited measurements is considered. The control used is the LQG or deterministic linear feedback control where the state estimate is generated by a recursive nonlinear filter. It is shown that the feedback nature of the control induces a natural probing which activates the filter. The results of this feedback system with a nonlinear filter in the feedback loop are compared to a system with an extended Kalman filter in the feedback loop. The state estimation accuracy is also compared to the system without a control to demonstrate how the control activates the nonlinear filter. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-28887 Rutgers Univ., New Brunswick, N.J.
THE HOMOLOGICAL DIMENSIONS OF SYMMETRIC ALGEBRAS Ph.D. Thesis
James Edward Carrig 1976 48 p
Avail: Univ. Microfilms Order No. 76-16390

The Noetherian domain, of a finite global dimension, and finitely generated module, were studied. Theorems are given. Also considered is the Tor-Dimension. Dissert. Abstr.

N76-28888 California Univ., Los Angeles.
THE EFFECTS OF INCLUDING A DICHOTOMOUS VARIABLE IN LINEAR DISCRIMINANT ANALYSIS Ph.D. Thesis
David Sachio Sugano 1976 97 p
Avail: Univ. Microfilms Order No. 76-15961

An analysis for the two population classification problem is presented. The relative merits of the linear discriminant functions including and excluding a dichotomous variable are evaluated with respect to the Bayes procedure for the point biserial normal model. Equations defining procedures and their respective correct classification probabilities were derived first. Then conditions for the equivalence of the different procedures were examined. Finally, for the purpose of comparing these procedures, numerical results were generated for selected parameter configurations of a canonical form for the point biserial model. Both the analytical and numerical results indicate that, for most of the parameter configurations investigated, including a dichotomous variable in the linear discriminant function and treating it as if it were continuous yields a higher probability of correct classification than excluding it from the function entirely. Dissert. Abstr.

N76-28889 Cornell Univ., Ithaca, N.Y.
COUPLING METHODS FOR MARKOV PROCESSES Ph.D. Thesis
David Scott Griffeath 1976 84 p
Avail: Univ. Microfilms Order No. 76-15914

An approach is presented to limit theorems for Markov processes. The coupling method, basic examples, and the existence of a maximal coupling which sends the joint process to delta as efficiently as possible are discussed. Applications to nonhomogeneous Markov processes, a coupling proof of Orey's ergodic theorem, and new rates of convergence results are given. Dissert. Abstr.

N76-28890 State Univ. of New York, Stony Brook.
STUDIES IN TIME-DEPENDENT CORRELATION FUNCTIONS Ph.D. Thesis
Genevieve Man-Yee Yue 1976 142 p
Avail: Univ. Microfilms Order No. 76-14603

Some studies in time-dependent correlation functions are reported. The self-consistent approximation method developed by Blume and Hubbard is extended to systems where two unlike spin species interact with each other and among themselves. From this approximation, self-consistent dynamical equations for the time-dependent spin-spin correlation functions are derived. These equations are applied to the study of NMR lineshapes. In particular, the NMR line-shape for hyperfine coupled paramagnets is calculated. The electronic spins, which are far off resonance, can contribute to the lineshape. This contribution will be important if the nuclear spin-nuclear spin correlation function has a large line-width. Experiments are suggested where this effect can be observed. Finally the theoretical results are compared with experimental data in KMnF3, PbMnF3, MnO, alpha Mns and MnSe. The results are closer to experiment than those from previous calculations. The lineshapes are in satisfactory agreement with experimental data for the anion resonances, while for the magnetic ions, they are not yet satisfactory. Dissert. Abstr.

N76-28891 Florida State Univ., Tallahassee.
GREEN'S FUNCTION DIAGRAMMATIC TECHNIQUE FOR COMPLICATED LEVELS SYSTEMS Ph.D. Thesis
David Hsing-Yen Yang 1975 213 p
Avail: Univ. Microfilms Order No. 76-16551

A self-consistent Green's function diagrammatic expansion technique was developed using standard basis operators. A Wicklike theorem was first shown followed by a discussion of the diagrammatic representation. Guided by a priority rule all possible vertices were considered. Rules for construction and evaluation of diagrams are given and summation of diagrams is discussed. The technique proved to be a powerful approach for the study of complicated level systems for the whole temperature range. The technique was first applied to a spin 1 Heisenberg ferromagnet with easy-axis single-ion anisotropy. Spin wave energies, correlation functions, and magnetization were calculated. Critical temperature was determined and compared with the values obtained by the high temperature expansion techniques. Application of the technique was also made to two Ising systems which exhibited interesting critical phenomena: the Blume-Capel model and the Ising 1/2 antiferromagnet in the longitudinal field. Calculation to the zeroth and first order was carried out. A detailed discussion of the thermodynamic quantities, and particularly those related to the phase transition behavior is given. Dissert. Abstr.

N76-28892 California Univ., Berkeley.
ON LINEAR DIFFERENCE-DIFFERENTIAL EQUATIONS WITH MULTIPLE TIME DELAYS Ph.D. Thesis
Wenhon Cheng 1975 106 p
Avail: Univ. Microfilms Order No. 76-15136

The stability of time invariant differential equations with multiple delays was studied. An algebraic method of determining the stability boundaries in the delay parameter space for this system was devised. The method is a generalization of the Tau-decomposition method developed previously for systems with single delay. The results of the present study were applied to three examples to demonstrate the use of the method and its advantages. The steady state response of a dynamical system subjected to a periodic forcing was also studied. The system is governed by a functional differential equation with periodic coefficients, and it is assumed to be asymptotically stable when the external periodic forcing is absent. A representation of the steady state response through a mapping of the periodic forcing was developed. The mapping allowed the reducing of the original problem to a boundary-value-like problem which required evaluation only through a finite time interval. To demonstrate the use of this representation, examples are given.
Dissert. Abstr.

N76-28893 Johns Hopkins Univ., Baltimore, Md.
THE STRUCTURE OF FACTORABLE VOLTERRA SYSTEMS Ph.D. Thesis
Thurman Russell Harper 1976 153 p
Avail: NTIS Avail: Univ. Microfilms Order No. 76-16821

Structural features are considered for a class of nonlinear systems composed of K linear dynamic subsystems connected in parallel with the outputs multiplied (in the time domain). Concepts of reachability and observability are defined and characterized in terms of internal and external representations involving rank conditions, properties of the eigenvalues of the state variable representation and common factors in the Volterra transfer function or its associated transform. An algorithm for realization from the symmetric Volterra transfer function is provided. Dissert. Abstr.

N76-28894 Vanderbilt Univ., Nashville, Tenn.
DISTRIBUTIONAL BOUNDARY VALUES FOR SOLUTIONS TO ELLIPTIC DIFFERENTIAL EQUATIONS Ph.D. Thesis
Phillip Osborne Staples, Jr. 1975 56 p
Avail: Univ. Microfilms Order No. 76-15508

Boundary values of solutions to certain second-order elliptic differential equations with C to infinity coefficients are examined. This problem was first suggested by Richard Courant and has been solved for the case of real analytic coefficients by Lions and Magenes. A brief account is given of how this characterization is done for Laplace's equation in the unit disk. The testing space G is introduced, and its topology is defined to be the inductive limit of a sequence of Banach spaces. G is then shown to be a Montel space. The boundary values of solutions to certain elliptic equations that are isomorphic to G are described. Finally, a class of second-order elliptic linear operators is presented which satisfies the hypothesis of the representation theorem. In particular, this class includes Laplace's equation, as well as many elliptic equations with real analytic coefficients as special cases.
Dissert. Abstr.

N76-28895 California Univ., Berkeley.
SOLUTIONS OF NONLINEAR DIFFERENTIAL EQUATIONS BY DISCRETE LEAST SQUARES Ph.D. Thesis
Ernest Day Eason 1975 59 p
Avail: Univ. Microfilms Order No. 76-15169

A discrete least squares method was developed for solving nonlinear boundary and initial value problems. A nonlinear least squares algorithm was used to minimize the boundary and interior residuals at discrete fitting points. Initial value problems were integrated at the fitting points by a predictor-corrector algorithm. The resulting formulation was independent of the form of the problem, facilitating development of general-purpose computer programs. The technique was tested on six boundary and initial value problems in one spatial dimension. Results were compared with exact solutions and published finite difference and weighted residual finite element solutions. In all but one case, the technique is more accurate or faster or both, and it automatically provides an indication of the accuracy of the approximate solution. The entire set of problems may be solved with only minor program and data changes, using general approximating functions such as global or local power or Chebyshev series. Dissert. Abstr.

N76-28896 Minnesota Univ., Minneapolis.
A COLLOCATION METHOD FOR PARABOLIC AND ELLIPTIC QUASILINEAR PROBLEMS ON GENERAL DOMAINS Ph.D. Thesis
Uri Michael Ascher 1975 168 p
Avail: Univ. Microfilms Order No. 76-14866

A method is described for efficiently obtaining approximate solutions to quasilinear parabolic and elliptic problems. Solutions are obtained on a general two dimensional domain using an interactive graphics system for both problem formulation and display of results. For the initial boundary value parabolic problem, the initial value data are approximated in the discrete L sub 1 norm using linear programming. This determines a set of collocation points at which the approximate solution exactly satisfies the initial data. The time dependent solution is then carried forward by satisfying the differential equation on the interior collocation points and the boundary data on the boundary collocation points. The approximate solution is given in terms of a B-spline basis so that a finite element method is used.
Dissert. Abstr.

N76-28897*# Lehigh Univ., Bethlehem, Pa.
MIXED BOUNDARY VALUE PROBLEMS IN MECHANICS
F. Erdogan Apr. 1975 113 p refs Sponsored in part by NSF
(Grant NGR-39-007-011)
(NASA-CR-145042) Avail: NTIS HC $5.50 CSCL 12A

Certain boundary value problems were studied over a domain D which may contain the point at infinity and may be multiply connected. Contours forming the boundary are assumed to consist of piecewise smooth arcs. Mixed boundary value problems are those with points of flux singularity on the boundary; these are points on the surface, either side of which at least one of the differential operator has different behavior. The physical system was considered to be described by two quantities, the potential and the flux type quantities. Some of the examples that were illustrated included problems in potential theory and elasticity.
Y.J.A.

N76-28898*# Space System Associates, Silver Spring, Md.
LONG PERIOD COUPLING TERMS FOR LAGRANGE'S EQUATIONS
1976 43 p refs
(NASA Order S-54266-A)
(NASA-CR-144780) Avail: NTIS HC $4.00 CSCL 12A

A generalization of that portion of the work of Berger, which

deals with the long period coupling effect of certain pairs of zonal harmonics. Long period terms arising from the short short period coupling of zonal harmonics are derived for Lagrange's equations. The formulation is general so that the results are valid for any pairs of zonal harmonics. Formulas are given to generate the various functions and integrals needed for the results given. Checks have been made against the work of Kozai.
Author

N76-28899*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF AN INVERSE RAYLEIGH TYPE RANDOM VARIABLE
D. V. Iliescu and V. Gh. Voda Washington NASA Jul. 1976 23 p refs Transl. into ENGLISH from Studii Cercetari Mat. (Bucharest), v. 25, no. 10, 1973 p 1507-1521
(Contract NAS7-100)
(NASA-TT-F-16758) Avail: NTIS HC $3.50 CSCL 12A

Some estimates for the parameter are constructed with the aid of the loss function method and maximum likelihood method. Kulldorff's theorem is applied to prove that the maximum likelihood estimate is consistent and asymptotically efficient. In the latter part of the paper, a sequential test of the Girshick type is constructed in order to compare two populations subjected to the inverse Rayleigh law. Author

N76-28900# California Univ., Livermore. Lawrence Livermore Lab.
GEARS: SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS HAVING A SPARSE JACOBIAN MATRIX
J. W. Spellmann and A. C. Hindmarsh Aug. 1975 41 p refs
(Contract W-7405-eng-48)
(UCID-30116) Avail: NTIS HC $4.00

GEARS is a package of subroutines for the numerical solution of systems of ordinary differential equations in which the Jacobian matrix has a sparse structure. GEARS was created by merging modified versions of GEAR and the Yale Sparse Matrix Package (YSMP). Although the primary emphasis in GEARS is on stiff systems, it may be used, in general, for problems with various degrees of stiffness. As with GEAR, the GEARS package used either the implicit Adams methods or backward differentiation formulas for solving the system of equations. Also, the user has several options with regard to the Jacobian of the system.
Author (ERA)

N76-28901# Sandia Labs., Livermore, Calif.
ENGINEERING MATHEMATICS REFRESHER COURSE, PART 2
M. A. Soderstrand Oct. 1975 177 p
(Contract AT(29-1)-789)
(SAND-74-8221-Pt-2) Avail: NTIS HC $7.60

This is the second of two six-week Engineering Mathematics Refresher Courses to be given in Sandia Laboratories in Livermore, California. The goal of these courses is to sharpen the student's abilities in areas which may have become rusty over the years. This second six-week course consists of one week each of complex variables; vector, matrix, and tensor techniques; systems of differential equations; infinite series and Fourier analysis; numerical techniques and computer analysis; probability and statistics. Weekly assignments, homework problems, examinations, and lecture notes are included in this text. In addition, reading in other textbooks and optional or reference reading are also assigned. Author (ERA)

N76-28902# Stanford Univ., Calif. Dept. of Computer Science.
SOLVING PATH PROBLEMS ON DIRECTED GRAPHS
Robert E. Tarjan Nov. 1975 49 p refs
(Contract N00014-67-A-0112-0057; Grant NSF DCR-72-03752-A02; NR Proj. 044-402)
(AD-A020597; SU-STAN-CS-75-528) Avail: NTIS CSCL 12/1

This paper considers path problems on directed graphs which are solvable by a method similar to Gaussian elimination. The paper gives an axiom system for such problems which is a weakening of Salomaa's axioms for a regular algebra. The paper presents a general solution method which requires O(n sup 3) time for dense graphs with n vertices and considerably less time for sparse graphs. The paper also presents a decomposition method which solves a path problem by breaking it into subproblems, solving each subproblem by elimination, and combining the solutions. The paper considers variants of the axiom system for which the solution methods still work, and presents several applications, including solving simultaneous linear equations and analyzing control flow in computer programs. GRA

N76-28903# California Univ., Berkeley.
USING RESIDUALS ROBUSTLY. 1: TEST FOR HETEROSCEDASTICITY, NONLINEARITY, NONADDITIVITY
P. J. Bickel Nov. 1975 74 p refs
(Contract N00014-69-A-0200-1038; Grant NSF GP-38485; NR Proj. 042-036)
(AD-A020522) Avail: NTIS CSCL 12/1

Transformed residuals were employed to construct tests for heteroscedasticity, nonlinearity and nonadditivity in the linear model and study their asymptotic power functions. The results are connected with previous work of Anscombe and Tukey, Box and Cox and others. GRA

N76-28904# Colorado State Univ. Research Foundation, Fort Collins. Dept. of Mathematics.
A UNIFORM RATIONAL APPROXIMATION PROGRAM WITH APPLICATIONS TO RECURSIVE FILTER DESIGN
G. D. Taylor and E. H. Kaufman, Jr. (Univ. Michigan) 1975 9 p refs
(Grant AF-AFOSR-2878-76; AF Proj. 9749)
(AD-A020684; AFOSR-76-0064TR) Avail: NTIS CSCL 12/2

A general algorithm which uses linear programming to compute rational approximations is discussed. This algorithm allows independent upper and lower constraints to be imposed on the frequency response of a recursive digital filter. Experimental results have been excellent. A FORTRAN listing of this program is available. GRA

N76-28905# Martin Marietta Corp., Baltimore, Md.
NUMERICAL EVALUATION OF THE 3-D HARMONIC KERNEL Interim Report
Peter F. Jordon 1975 21 p refs
(Contract F44620-73-C-0041; AF Proj. 9781)
(AD-A020593; AFOSR-76-0004TR) Avail: NTIS CSCL 12/1

In the current method of numerically evaluating the Kernel function of unsteady lifting surface theory, a set of constants due to Laschka is used in a manner whereby much of the accuracy and reliability of the original Laschka results is lost. The cause of this loss is discussed, and a new set of constants is presented which is (a) somewhat simpler than the Laschka set, (b) restores the lost accuracy to well within the practically required degree in the range of small values of u, and (c) extends the range of acceptable accuracy to larger values of u. Non-planar lifting surfaces are included in the discussion. GRA

N76-28906# California Univ., Santa Barbara. Inst. for Algebra and Combinatorics.
ALGEBRAIC ASPECTS OF STABILITY; A LINEAR ALGEBRA BIBLIOGRAPHY Interim Report
Marvin Marcus, Henryk Minc, and Robert C. Thompson 30 Sep. 1975 34 p refs
(Grant AF-AFOSR-2164-72; AF Proj. 9749)
(AD-A020661; AFOSR-76-0006TR) Avail: NTIS CSCL 12/1

During the period of this grant one book appeared. There were a total of fourteen papers that appeared; sixteen papers that were submitted for publication; and six papers that were completed and are being prepared for submission. GRA

N76-28907# California Univ., Los Angeles. Dept. of System Sciences.
A PENALTY FUNCTION PROOF OF THE MAXIMUM PRINCIPLE Interim Report
Leonard Berkovitz 1975 23 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 9769)
(AD-A020663; AFOSR-76-0048TR) Avail: NTIS CSCL 12/1

In this paper we present a penalty function proof of the maximum principle for relaxed optimal controls which we feel is simpler than the standard proofs. The proof is also valid for ordinary controls that are solutions of the relaxed problem. We

do not utilize the separation theorem for convex sets and the Brouwer fixed point theorem or its equivalent. Author (GRA)

N76-28908# Florida State Univ., Tallahassee. Dept. of Statistics.
SIGN CHANGES OF LINEAR COMBINATIONS OF DERIVATIVES OF POLYA FREQUENCY FUNCTIONS
Frank Proschan and Steven Nahmias (Pittsburgh Univ.) Nov. 1975 10 p refs
(Grant AF-AFOSR-2581-74; NSF ENG-75-04990)
(AD-A020996; FSU-Statistics-M359; AFOSR-76-0008TR) Avail: NTIS CSCL 12/1

The authors obtain upper bounds on the number of sign changes of linear combinations of derivatives of Polya frequency functions using the variation diminishing properties of totally positive functions. These constitute extensions of earlier results of Karlin. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-28909 California Univ., Berkeley.
OPTIMIZATION OF DISTRIBUTED PARAMETER SYSTEMS BY DYNAMIC PROGRAMMING Ph.D. Thesis
Simson Ching-Sheng Fond 1975 101 p
Avail: Univ. Microfilms Order No. 76-15177

The Euler partial differential equation for variational problems with two independent variables and the maximum principle for the optimal control of systems with distributed parameters were obtained. The process of the control problems under consideration is governed by a partial differential equation. Both results are developed by dynamic programming methods. Furthermore, a necessary condition for a stochastic optimal control problem with discrete time and continuous state is developed, where the process is again governed by a partial differential equation but with a random variable. Dissert. Abstr.

N76-28910 California Univ., Berkeley.
THE ALMOST REGENERATIVE METHOD FOR STOCHASTIC SYSTEM SIMULATIONS Ph.D. Thesis
Francis Linus Gunther 1975 81 p
Avail: Univ. Microfilms Order No. 76-15202

An almost regenerative method for complicated stochastic systems (such as a network of queues) was introduced as an extension of the regenerative method in order to alleviate the problem that, relative to a fixed run length, the mean time between entries may be excessively long, providing few observations and poor variance estimates. The almost regenerative method allows data collection each time the stochastic process enters a set of states. Simulations of simple queueing networks show that the almost regenerative method can provide an order of magnitude improvement over the regenerative method in terms of the mean-square-error of the estimator of total delay in queue, and this relative improvement increases with system complexity. In addition, the resulting variance estimates are shown empirically to be superior to variance estimates generated by the regenerative method. Dissert. Abstr.

N76-28911 Georgia Inst. of Tech., Atlanta.
STOCHASTIC DECISION PROCESSES IN LOCATION ANALYSIS Ph.D. Thesis
Richard Edwin Rosenthal 1975 159 p
Avail: Univ. Microfilms Order No. 76-15517

The specific model concerns making dynamic relocation decisions for a new facility (server) that must interact with existing facilities (customers) whose relocations are stochastic processes. The model is an infinite-horizon Markov decision chain whose solution gives a server relocation policy that minimizes the expected discounted sum of costs. Costs are location-dependent and are incurred in two ways: when the server makes choice relocations and when the server interacts with customers. The model captures the essence of a variety of familiar dynamic location decision situations. Solutions generally have the server loosely pursuing real and anticipated customer moves, balancing the cost of relocating against the advantage of being favorably situated for future interaction costs. Dissert. Abstr.

N76-28912*# Scientific Translation Service, Santa Barbara, Calif.
COST-OPTIMIZED TEST DESIGNING IN THE REGRESSION MODEL
W. Jung Washington NASA Jul. 1976 25 p refs Transl. into ENGLISH from Biom. Z., vol. 16, no. 1, 1974 p 31-47
(Contract NAS7-100)
(NASA-TT-F-16746) Avail: NTIS HC $3.50 CSCL 12A

Test designing in the regression model is discussed with special emphasis on experimental effort. The effort is defined as a generalized cost function (such as effort in terms of money, time, and materials). Author

N76-28913*# Scientific Translation Service, Santa Barbara, Calif.
OPTIMAL SAMPLE SIZE WITH A-PRIORI INFORMATION ABOUT CERTAIN PARAMETERS
H. Bandemer and D. Stoyan Washington NASA Jul. 1976 12 p Transl. into ENGLISH from Biometrische Z. (Germany), v. 13, 1971 p 376-382
(Contract NAS7-100)
(NASA-TT-F-16747) Avail: NTIS HC $3.50 CSCL 12A

A mathematical discussion dealing with the selection of the optimum size of a statistical sample, so as to minimize the sum of sample costs and risk, was presented. This was based on the fact that, in general, the risks will decrease with increases in the sample size n while the sample costs K(n) increase with increasing n. Two numerical examples illustrating the theory were given. Y.J.A.

N76-28914*# Scientific Translation Service, Santa Barbara, Calif.
DESIGNS FOR SEQUENTIAL TRIALS AND DISCRIMINATION AMONG MODELS
Michel Bataille Washington NASA Jul. 1976 22 p refs Transl. into ENGLISH from Rev. Statist. Appl. (France), v. 21, 1973 p 67-80 Prepared for JPL
(Contract NAS7-100)
(NASA-TT-F-16759) Avail: NTIS HC $3.50 CSCL 12A

The problem is considered of choosing between two statistical models, the parameters of which are functions of the successive trials chosen. The theory of sequential trail design is generalized and methods and examples for problem solving by the theory of continuous games are given. Finally, limits to the validity of this approach are elaborated. Author

N76-28915# Florida State Univ., Tallahassee. Dept. of Statistics.
STOCHASTIC COMPARISONS OF ORDER STATISTICS FROM HETEROGENEOUS POPULATIONS, WITH APPLICATIONS IN RELIABILITY
F. Proschan Oct. 1975 19 p refs
(Grants AF-AFOSR-2581-74; DAHC04-74-G-0188)
(AD-A020427; FSU-Statistics-M310-R; TR-35-R; ARO-1053.17-M) Avail: NTIS CSCL 12/1

Whole vectors of order statistics are stochastically compared. It is shown that some of these results concerning stochastic comparison of sums remain valid if the sample is not ordered, but instead uses the ordering specified by the constants of proportionality of the hazard functions. GRA

N76-28916# Florida State Univ., Tallahassee. Dept. of Statistics.
PROBABILITIES OF EXCESSIVE DEVIATIONS OF SIMPLE LINEAR RANK STATISTICS
Robert P. Clickne and Jayaram Sethuraman Feb. 1975 34 p refs
(Grant DAHC04-74-G-0188)
(AD-A020428; FSU-Statistics-M311; ARO-10530.18-M; USARO-D-TR-12) Avail: NTIS CSCL 12/1

Simple linear rank statistics arise in a variety of situations, particularly in the problem of testing the equality of two or more distributions by non-parametric tests. While the asymptotic distributions of simple linear rank statistics have been studied extensively (see, e.g., Hajek and Sidak (1967)), investigations concerning their large deviation properties have been made only recently (Stone (1967, 1968, 1969) and Woodworth (1970)). In this paper the authors study the rates of convergence to

zero of null probabilities of excessive deviations of k-sample (k = or = 2) simple linear rank statistics. GRA

N76-28917# California Univ., Berkeley. Dept. of Statistics.
ON A FUNDAMENTAL THEOREM IN MULTIPLE COMPARISONS
E. L. Lehmann and Juliet Popper Shaffer (Univ. of Kansas) Jan. 1976 9 p refs
(Contract N00014-75-C-0444; Grant NSF MPS-73-08698; NR Proj. 042-036)
(AD-A020526) Avail: NTIS CSCL 12/1

A recent paper by Einot and Gabriel restates a basic result for multiple range tests, which had earlier been given by Tukey and Spjotvoll. It is pointed out that this result requires for its validity an assumption which is not explicitly provided by any of these earlier versions. There is also some discussion of a related result. Author (GRA)

N76-28918# New York City-Rand Inst.
A SIMPLE APPROXIMATION TO THE AVERAGE QUEUE SIZE IN THE TIME-DEPENDENT M/M/1 QUEUE
Kenneth Lloyd Rider Jul. 1975 21 p refs
(AD-A020227; P-5288-1) Avail: NTIS CSCL 12/2

The time-dependent equations for the M/M/1 queue can be reduced to a single equation for the expected queue size, but the equation is dependent on (P sub 0)(t), the probability of no jobs in the system. An exact equation for the behavior of (P sub 0)(t) under special conditions is derived and an approximation relating (P sub 0)(t) to Q(t), the expected queue size at time t, is found for the case when the change in queue size is slow compared to the service rate. It is found that the approximation affords a significant improvement over the use of a steady-state approximation to the time-dependent queue and is simpler to use than the exact equations. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-28919 Texas Univ., Austin.
DESENSITIZED SPECIFIC OPTIMAL SYSTEM DESIGN UTILIZING DIGITAL SIMULATION BY PARTITIONING AND UNCOUPLING Ph.D. Thesis
Troy Floyd Henson 1975 297 p
Avail: Univ. Microfilms Order No. 76-14465

A digital computer simulation algorithm is developed for determining the desensitized optimal design vector which results in a specific optimal system design that is relatively insensitive to variations in the uncertain plant model parameters. In order to obtain the solutions to the system and sensitivity state equations which are required by the algorithm, a technique of digital simulation by partitioning and uncoupling the system model is developed. This digital-simulation technique is also shown to be valuable in itself, in terms of accuracy, efficiency, modularity and flexibility, as a simulation tool for complex dynamical systems. A simulation error introduced by this technique of partitioning and uncoupling is derived and analyzed in the form of a state variable model. The desensitized specific optimal systems design algorithm and the digital simulation by partitioning and uncoupling are applied to space-vehicle attitude and precision-pointing control systems, namely, the Saturn V Launch Vehicle, the Large Space Telescope, and the Shuttle Orbiter/Spacelab. Dissert. Abstr.

N76-28920 Case Western Reserve Univ., Cleveland, Ohio.
OPTIMAL DESIGN OF NETWORKS WITH NODE WEIGHTED FUNCTIONS Ph.D. Thesis
Shailesh Jayantilal Mehta 1975 77 p
Avail: Univ. Microfilms Order No. 76-16057

The problem of constructing optimal networks with node weights is considered. The objective function depends on the weights assigned to the nodes and the degree of the nodes. Special cases of the general design problem of constructing networks or graphs with node weights and arc weights are also treated. The general design problem is solved by polynomially bounded methods for the case when objective function depends on the weights assigned to the nodes and is linear with respect to the degree of the nodes. The design of the undirected spanning tree when objective function is nonlinear with respect to the degree of nodes is solved by a dynamic programming type algorithm. A modification in this algorithm for a special case of degree functions reduces computational effort considerably. Dissert. Abstr.

N76-28921 California Univ., Los Angeles.
SYNTHESIS OF NETWORKS AND SYSTEMS: A HILBERT SPACE APPROACH Ph.D. Thesis
Lee Clayborn Zimmerman 1976 142 p
Avail: Univ. Microfilms Order No. 76-16669

The canonical synthesis of a class of infinite dimensional networks represented by a scattering operator on a Hilbert space is studied. This synthesis is based on the Nagy-Foias model theory for contraction operators. A contractive analytic function corresponding to the scattering operator of a passive network is used to construct the Nagy-Foias space. It is shown that this space can be taken as a state space. The Nagy-Foias model for the given contractive analytic function is the compressed shift operator on this space. The characteristic operator function of the compressed shift represents the cascade load synthesis of the network. The given contractive analytic function can also be regarded as the transfer operator of a linear, time invariant, dynamic system. Dissert. Abstr.

N76-28922 Texas Univ., Austin.
LOCAL BALANCE MODELS OF COMPUTER SYSTEMS Ph.D. Thesis
Donald Fred Towsley 1975 155 p
Avail: Univ. Microfilms Order No. 76-14527

Queueing network models are presented for computing systems including state dependent routing and the simultaneous use of several devices by one job. Efficient numerical and approximate analysis techniques are presented for a large class of central server networks containing these features. These techniques are based on extensions to the efficient solution techniques existing for networks satisfying the properties of local or station balance. These extensions include a more complete characterization of networks exhibiting local balance and efficient solution techniques for networks with state dependent routing. Examples of the utility of these models are presented throughout. Dissert. Abstr.

N76-28923 Texas Univ., Austin.
PARTITIONED NETWORKS FOR THE MATHEMATICAL MODELING OF NATURAL LANGUAGE SEMANTICS Ph.D. Thesis
Gary Grant Hendrix 1975 404 p
Avail: Univ. Microfilms Order No. 76-14464

A modeling scheme is reported for use in artificially intelligent natural language understanding which is capable of encoding knowledge about the world in a uniform, precise and easily manipulatable form. Certain human like organization schemes are imposed upon the set theoretic models so that knowledge becomes grouped into bundles which are meaningful and convenient units for discourse. The organization schemes include a hierarchical classification of objects and the packaging of sets of related changes into units called processes. Processes are defined by process automata structures capable of encoding discrete, continuous and parallel change. To facilitate use by computers, the set theoretic modeling scheme is mapped onto a network representation. This network representation provides easily accessible cross linkage between semantically related pieces of information, thus facilitating algorithms which interrogate the information modeled in the network. Dissert. Abstr.

N76-28924 Kansas Univ., Lawrence.
AN ANALYTICAL MODEL OF A COMPUTER SYSTEM Ph.D. Thesis
John Thomas Peterson 1975 111 p
Avail: Univ. Microfilms Order No. 76-16765

An analytical model is cheaper to construct and use than a simulation model or a benchmark, and effectively sets a limit on the scope of the study. The disadvantage of an analytical model is its relative inaccuracy. The model proposed is more

accurate than its predecessors. In most studies, the analytical model is a job-shop model which makes it possible to compute the projected utilizations of the CPU and I/O channels from the projected number of tasks and their mean service times, service distributions, and I/O channel selection probabilities. The model proposed treats double buffering and all the queuing disciplines commonly used in batch computing systems. Dissert. Abstr.

N76-28925 Brown Univ., Providence, R.I.
A SYSTEM FOR INTERCONNECTED PROCESSING Ph.D. Thesis
George Merritt Stabler 1975 189 p
Avail: Univ. Microfilms Order No. 76-15719

The motivation, design, and implementation of ICOPS (an inter connected processore system) is described. Also described is the implementation of a full-scale application system which runs on ICOPS. While frequent reference is made to the particular problems posed by graphics applications, the design aims of the system apply equally well to other uses of distributed computing. The major premises of ICOPS was that it should be no more difficult to implement an application on a mainframe/satellite graphics system than it should be on single processor-local display facility. In particular, it should be possible for the application programmer to: (1) avoid learning new languages and operating systems in order to develop programs for the satellite system; (2) ignore the ramifications of performing I/O across the interprocessor communications link; (3) be able to reconfigure dynamically the distribution of his application between processors on the basis of observed response time, cost, and mainframe load. Dissert. Abstr.

N76-28926 Brown Univ., Providence, R.I.
THE COMPLEXITY OF MONOTONE FUNCTIONS Ph.D. Thesis
Edmund Arthur Lamagna 1975 106 p
Avail: Univ. Microfilms Order No. 76-15654

Two important measures of functional complexity are combinational complexity, corresponding to the minimal number of operations in any computational chain (straight-line algorithm or feedback-free network) for the function, and formula size. It was demonstrated that most Boolean functions of n variables have a formula size growing approximately exponentially in n, while no specific function is known to have size greater than quadratic in n. Monotone increasing Boolean functions are considered. These correspond to the functions which can be computed using only OR and AND operations, an incomplete set of primitives. Techniques for proving functions of n inputs and O(n) outputs have nonlinear combinational complexity are developed, if only OR and AND operations are allowed in their computation. Dissert. Abstr.

N76-28927 State Univ. of New York, Stony Brook.
DESIGN TRADEOFFS FOR NETWORK COMMUNICATIONS Ph.D. Thesis
Richard Van Huber 1975 131 p
Avail: Univ. Microfilms Order No. 76-14602

Tradeoffs and constraints that arise in the design of an operating system for a network environment are described. First, a number of properties and features of interprocess communications systems are presented, with emphasis on those necessary or desirable in a network environment. The interactions between these features are examined, and the consequences of their inclusion in a system are explored. Other topics discussed include: the time-out feature; the differences between a message oriented and a connection oriented interprocess communication system; the problems of protection in a network environment; and a mechanism called monetary capabilities. Dissert. Abstr.

N76-28928 Illinois Univ., Urbana.
A STUDY OF CURRENT LOGIC DESIGN PROBLEMS. PART 1: DESIGN OF DIAGNOSABLE MOS NETWORKS. PART 2: MINIMUM NOR (NAND) NETWORKS FOR PARITY FUNCTIONS OF AN ARBITRARY NUMBER OF VARIBLES. PART 3: MINIMUM PARALLEL BINARY ADDERS WITH NOR (NAND) GATES AND THEIR EXTENSIONS TO NETWORKS CONSISTING OF CARRY-SAVE ADDERS Ph.D. Thesis
Hung Chi Lai 1976 382 p
Avail: Univ. Microfilms Order No. 76-16153

Logic design problems which arise in the design of economical networks for large-scale integrated circuits are studied. The design of diagnosable MOS networks, minimum NOR (or NAND) networks for parity functions of an arbitrary number of variables, and minimum networks for n-bit parallel binary adders are among the topics studied. Networks consisting of carry-save adders are also considered. Dissert. Abstr.

N76-28929 Georgia Inst. of Tech., Atlanta.
ESTIMATION IN DISTRIBUTED PARAMETER SYSTEMS Ph.D. Thesis
Raman Kumar Sahgal 1976 129 p
Avail: Univ. Microfilms Order No. 76-16451

The research to develop estimation algorithms for noisy dynamical systems represented by partial differential equations, and to evaluate their performance on a digital computer is reported. Filtering and smoothing algorithms are developed for noisy vector distributed systems, each of whose components is at most second order. Two classes of systems are assumed: those for which noise statistics are known and those whose noise statistics are unknown. For the first class distributed white disturbances in the dynamics and measurements are assumed and the innovations approach is used. For systems where the noise statistics are unknown, a least squares fit estimation approach is used. The solution to the boundary value problem is obtained using invariant embedding, converting it into an initial (or final) value problem. The results of these algorithms are applied to representative problems in engineering, and compared with previously existing algorithms. Dissert. Abstr.

N76-28930 California Univ., Berkeley.
ON THE MODELING OF SOME CLASSES OF NONLINEAR DEVICES AND SYSTEMS Ph.D. Thesis
Sung Mo Kang 1975 172 p
Avail: Univ. Microfilms Order No. 76-15251

The modeling of nonlinear memristive devices and systems and adaptive devices and systems has been investigated and their canonical models have been derived. Several other canonical models for the response behavior of nonlinear dynamical systems under various input signals have also been derived. A broad generalization of memristors -- a recently postulated circuit element -- to an interesting class of nonlinear dynamical system is introduced. Generic properties of memristive systems are derived and a canonic dynamical system model is presented along with an explicit algorithm for identifying the model parameters and functions. A class of adaptive devices and systems is investigated, and a mathematical definition for an adaptive system is presented. Dissert. Abstr.

N76-28931 Pittsburgh Univ., Pa.
ASPECTS OF LAYOUT OF MULTI-NET IN MULTI-LAYER OVER RECTILINEAR METRIC Ph.D. Thesis
Jerry Hwai Lee 1975 237 p
Avail: Univ. Microfilms Order No. 76-15586

A comprehensive study of Steiner's problem was made. Rigorous proofs for the necessary condition which must be satisfied by a Steiner minimal tree in Euclidean metric are included. Similar necessary conditions in rectilinear metric are also discussed. It was conjectured that the ratio of the total length of a Steiner minimal tree over the corresponding minimal spanning tree in rectilinear metric is greater than or equal to 2/3. A constructive sub-optimal algorithm for routing a single net was advanced, and test results based on its use are reported for comparison with an existing algorithm. Two partitioning algorithms for assigning nets to multilayers are given. Finally, an algorithm to find a sub-optimal wiring pattern for a multi-net is given, subject to the constraint of minimum length and maximum allowable channel capacity. The multi-net, multi-layer wiring problem can be reduced to the multi-net, single-layer or single-net, single-layer problem by the use of an appropriate partitioning algorithm. Dissert. Abstr.

N76-28932 California Univ., Berkeley.
A QUALITATIVE STUDY OF THE BEHAVIOR OF DYNAMIC NONLINEAR NETWORKS Ph.D. Thesis
Douglas Nathaniel Green 1975 299 p
Avail: Univ. Microfilms Order No. 76-15197

Graph theoretic concepts are used to deduce properties of nonlinear networks and properties of nonlinear resistive n-ports. The basic result is that if the ports of an n-port form no loops and form no cutsets, then the port voltages and currents are linear functions of the internal voltages and currents only; i.e., no other external port voltage or port current is involved. This result is very general in the sense that it is independent of the constitutive relations of the internal n-port elements. It is also a rather subtle result because it forms the basis of a large number of network and n-port theorems. For example, in examining the closure properties of n-ports, this result is used to show that if the resistors of an n-port are passive or strictly increasing, or eventually strictly passive, etc., then the n-port also has the property. Many of these conclusions remain valid when the n-port contains independent voltage and current sources.
Dissert. Abstr.

N76-28933*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STABILITY ANALYSIS OF COMBINED CONTINUOUS AND DISCRETE SYSTEMS
Wayne Johnson (Army Air Mobility R and D Lab., Moffett Field, Calif.) Apr. 1976 12 p ref
(NASA-TM-X-73138; A-6616) Avail: NTIS HC $3.50 CSCL 12B

A discrete, time-invariant system is represented by an equivalent continuous, periodic system. A combined continuous plant and discrete controller may then be formulated as a single continuous, periodic coefficient system. The exact stability solution for the combined system is obtained, as a matrix eigenvalue problem. Periodic system theory also gives some information about the type of instabilities which may be encountered in the combined plant and controller. Author

N76-28934# California Univ., Livermore. Lawrence Livermore Lab.
SUBNET: A PREPROCESSOR FOR MANAGEMENT OF COMPLEX CPM NETWORKS
J. R. McCall 22 Sep. 1975 13 p
(Contract W-7405-eng-48)
(UCID-16928) Avail: NTIS HC $4.00

Procedures are described that facilitate the use of Critical Path Method (CPM) networks used in the management of large, complex sets of activities. Instructions for use of CPM software on the LLL Octopus system are given, and examples of output are presented. Author (ERA)

N76-28935# Southern Methodist Univ., Dallas, Tex. Dept. of Industrial Engineering and Operations Research.
THE G/M/S/N QUEUE WITH TWO CLASSES OF CUSTOMERS. PART 1: A PARAMETRIC ANALYSIS OF SYSTEM PERFORMANCE
U. Narayan Bhat, Sagi N. Raju, and Nohamed A. Shalaby Nov. 1975 50 p refs
(Contract N00014-75-C-0517; NR Proj. 042-324)
(AD-A020846; IEOR-75016) Avail: NTIS CSCL 12/2

In this paper a numerical investigation is carried out on the queueing system G/M/s/N with two classes of customers. Arriving class 1 customers are buffered subject to capacity limitations. Arriving class 2 customers are denied access to the system when the system is filled to capacity or more service channels are busy. In addition to determining some of the most significant performance measures of the system, the numerical analysis highlights the effect of the arrival process on measures such as the mean number in the system, mean delay, probability of blocking, channel utilization and mean busy cycle. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-28936 Rutgers Univ., New Brunswick, N.J.
RECURSIVENESS AND FINITE AXIOMATIZABILITY OF LINEAR ORDERINGS Ph.D. Thesis
Stephen Martin Fellner 1976 119 p
Avail: Univ. Microfilms Order No. 76-16396

Countable linear orderings are examined from a recursive point of view in order to characterize the class of all recursive order types. Dense sums of certain scattered types and the structure of various scattered oderings are studied. In both cases partial characterizations of the recursive order types involved are obtained. The finite axiomatizability of linear orderings is also examined. A structural characterization of the subclass of finitely axiomatizable linear orderings is given. Several structural conditions are obtained on a linearly ordered set which determine whether or not it is finitely axiomatizable. Dissert. Abstr.

N76-28937 Minnesota Univ., Minneapolis.
CURVATURE STRUCTURES ON LORENTZ 2-MANIFOLDS Ph.D. Thesis
John Thomas Burns 1975 55 p
Avail: Univ. Microfilms Order No. 76-14871

Functions which can arise as Gaussian curvatures on 2-dimensional Lorentz manifolds were studied. Specifically, the 2-dimensional torus T squared and the plane R squared were considered. The results illustrate a number of significant differences between curvature functions of Riemannian (positive definite) metrics A Lorentz metrics. A Lorentz metric g was prescribed on the manifold M and an attempt was made to realize a given function K as the curvature of a Lorentz metric which is pointwise conformal to g. This approach led to the problem of solving the nonlinear hyperbolic equation delta u = k - K(e sup 2*u), where k and delta are the Gaussian curvature and Laplace-Beltrami operator, respectively, in the given metric g. Dissert. Abstr.

N76-28938 Kansas Univ., Lawrence.
LATTICE-ORDERED GROUPS Ph.D. Thesis
George Otis Kenny 1975 71 p
Avail: Univ. Microfilms Order No. 76-16740

A lattice ordered group (l-group) is a partially ordered group which is also a lattice. The lattice order on an Abelian l-group is weakened and the open interval topology is defined using this new order. The reason for weakening the order is simply that for a nontotally order l-group, the open interval topology is always discrete. It is shown that there is a unique (up to isomorphism) Abelian l-group H such that (1) H is complete with respect to the natural uniformity given by the topology generated by any compatible tight Riesz order of H, 2) G is a large l-subgroup of H and (3)H is minimal with respect to (1) and (2). The concept is introduced of the Archimedean kernel, A(G), of G. A(G) is the largest convex l-subgroup of G which is Archimedean. It is shown that A(G) is a closed characteristic l-ideal of G. Dissert. Abstr.

N76-28939 California Univ., Berkeley.
THE INFINITE HARD-SPHERE SYSTEM Ph.D. Thesis
Roger Keith Alexander 1975 69 p
Avail: Univ. Microfilms Order No. 76-15092

The time-evolution for the system of infinitely many particles in space interacting with a hard-sphere potential was constructed. A regularity condition was imposed on the solutions which limits the growth of velocities and of the length of chains of particles close together for very large distances; it was proved that through any point of the phase space there passes at most one regular solution. Every point in a subset of the phase space is the initial point of a regular solution which is defined for all time. The subset is of full measure for every Gibss state and is invariant under the one-parameter group of shifts along solution trajectories. The solutions constructed are limits, for infinite distances, of motions in which particles inside the sphere of radius R are elastically reflected from its boundary while those outside remain fixed. Examples in which a single billiard moving in the plane is reflected infinitely often from a boundary curve were given.
Dissert. Abstr.

N76-28940 California Univ., Berkeley.
THE RAYLEIGH QUOTIENT ITERATION FOR NON-NORMAL MATRICES Ph.D. thesis
Nai-fu Chen 1975 80 p
Avail: Univ. Microfilms Order No. 76-15135

The Rayleigh Quotient Iteration (RQI) is a method for computing eigenvectors and eigenvalues of a square matrix. The global properties of RQI on non-normal matrices is investigated. results on nearly normal matrices with real eigenvalues are

obtained, and at the other extreme, results on completely degenerate matrices are also obtained. In particular, the question of global convergence of the vector iteration on a general matrix is reduced to the convergence of the scalar sequence of the Rayleigh quotients. In practice, the vector iteration always converges. The main difficulty in the degenerate case is that the iteration function is discontinuous near the eigenvector. An example is used to display the sectorial behavior of the iteration. Further a sequence of numbers that converges to the eigenvalue is constructed. Yet if the numbers are used as shifts will inverse iteration, the vector sequence fails to converge. Dissert. Abstr.

N76-28941 Princeton Univ., N.J.
A SMOOTH ACTION ON A SPHERE WITH ONE FIXED POINT Ph.D. Thesis
Elliott Victor Stein 1975 62 p
Avail: Univ. Microfilms Order No. 76-16566

It is shown that a compact lie group can act smoothly on a sphere so that one point is left fixed. Specifically, let G denote the binary icosahedral group, SL(2, Z sub 5). A smooth action of G with one fixed point on S to the 7th power is obtained. The idea of the construction is to define a type of 'differentiable' join of two known actions of G. One is a free linear action on S to the 3rd power and the other is an action of G on the Poincare sphere, sum to the 3rd power, having one fixed point. Completing the construction then depends on showing that a normal map, can be modified by surgery, with the boundary fixed, to obtain a homotopy equivalence. The solution involves a geometric analysis of a cell structure for certain three-manifolds leading to an explicit expression for the surgery obstruction in matrix form. Dissert. Abstr.

N76-28942 Illinois Univ., Urbana.
AN ALGEBRAIC GENERALIZATION OF INTEGRATION IN FREE GROUPS Ph.D. Thesis
Larry James Williams 1976 68 p
Avail: Univ. Microfilms Order No. 76-16212

Through the use of Hopf algebraic techniques, it is possible to construct, functorially, a coalgebra in the linear dual space of a Hopf algebra which generalizes the theory of integration in free groups. Although the primary applications given are to the theory of groups, the nature of the development produces some parallel results in the theory of Lie algebras. Information can be obtained about a free group F through a properly defined integration. Each element in F corresponds to a polygonal path in a certain Euclidean space, and an arbitrary polynomial of degree n is integrated along the path with respect to some coordinate. Each integral f(x)dxj defines a real valued function on F, and the collection of elements in F on which any polynomial of degree n-1 vanishes forms a subgroup of F. Dissert. Abstr.

N76-28943 Illinois Univ., Urbana.
SOME RESULTS ON BOUNDED ANALYTIC FUNCTIONS Ph.D. Thesis
Walter Scott McVoy 1976 52 p
Avail: Univ. Microfilms Order No. 76-16168

It is shown that H infinity, the algebra of bounded analytic functions on the unit disc, is coherent. It is also proven that the disc algebra A is not coherent. The main result is attained by proving and applying a variant of the Beurling-Lax Theorem on shift-invariant subspaces. In Section 1 of Part II, some minimum modulus theorems for analytic functions are proven. In Section 2, it is shown by means of a counterexample the results of Section 1 are the best possible. Dissert. Abstr.

N76-28944 Kansas Univ., Lawrence.
GROUPS OF DIVISIBILITY AND COMMUTATIVE GROUP RINGS Ph.D. Thesis
David Carson Lantz 1975 51 p
Avail: Univ. Microfilms Order No. 76-16744

This dissertation displays certain interconnections between the theories of Abelian groups and commutative algebra, and some results which exploit these interconnections. Domains, of which the complete integral closure can be taken any preassigned countable ordinal number of times are constructed. It is shown that uncountably many iterations of complete integral closure always results in a completely integrally closed domain. Some of the commutative-algebraic properties of the group ring over a commutative ring of an Abelian group are studied. Necessary and sufficient conditions for a commutative group ring to be locally Noetherian, locally Cohen-Macaulay, locally Gorenstein, or locally regular are given. It is shown that if the group has finite torsion-free rank and the coefficient ring is Noetherian Hilbert domain satisfying the second chain condition, then the group ring satisfies the second chain condition. Dissert Abstr.

N76-28945 California Univ., Berkeley.
HIGHER ORDER CURVATURE THEORY IN SPACE KINEMATICS Ph.D. Thesis
Yoram Dov Kirson 1975 148 p
Avail: Univ. Microfilms Order No. 76-15259

The concepts of ruled evolutes and their corresponding higher order trihedrons are introduced such that the kinematic interpretation of ruled surfaces includes spherical and planar kinematics as special cases. Based on the concept of ruled evolutes, characteristics (dimensionless scalars) are defined which, within stretch-rotation, characterize completely the higher order differential properties of a ruled surface corresponding to any chosen generator. Using dual numbers and screw calculus, a systematic procedure is established for the determination of canonical coordinate systems and instantaneous invariants - together they describe completely a rigid body in geometrically constrained motion in space. The instantaneous invariants are employed in the derivation of characteristic equations which describe the loci of all the lines of a moving rigid body having the same second order characteristics. A preliminary inquiry on spherical curves is presented, introducing the concepts of spherical evolutes and spherical higher order trihedrons.
Dissert. Abstr.

N76-28946*# Scientific Translation Service, Santa Barbara, Calif.
G-OPTIMAL EXPERIMENTAL DESIGN FOR THE REGRESSION FUNCTIONS y(x) = THETA1 + THETA2x
W. Jung Washington NASA Jul. 1976 10 p refs Transl. into ENGLISH from Biometrische Zeitschrift (West Ger.), vol. 13, issue 6, 1971 p 370-382
(Contract NAS7-100)
(NASA-TT-F-16756) Avail: NTIS HC $3.50 CSCL 12A

A mathematical technique was presented by which a linear regression function could be estimated by the method of least squares for a number n of experimental points. It is assumed that the measured values of the ordinates are realizations of the random variables which are pairwise independent and normally distributed. The abscissae are arranged in a matrix called the experimental design which is chosen in a definite optimal sense. The requirement of G-optimality occurs then for fixed n in the choice of one such experimental design which minimizes errors in the ordinates with respect to all designs of dimension n and rank 2. Y.J.A.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-28947 Minnesota Univ., Minneapolis.
AN INVESTIGATION ON THE BREAK-DOWN OF SOLUTIONS OF MODELS OF NONLINEAR VIBRATING STRINGS Ph.D. Thesis
Peter Hon-You Chang 1975 183 p
Avail: Univ. Microfilms Order No. 76-14875

The mixed initial boundary value problem of the quasilinear wave equation is considered by applying methods of Riemann invariants. It is shown that a local existence theorem can satisfy some convexity conditions and that solution eventually breaks down in the sense that some second order derivatives of the solution become unbounded. G.G.

N76-28948 California Univ., Berkeley.
STUDIES ON THE SPRING-PENDULUM Ph.D. Thesis
Jair Koiller 1975 185 p
Avail: Univ. Microfilms Order No. 76-15263

A two degrees of freedom mechanical system is studied; i.e. (x',y') = grad U(x,y), U(x,y) = U(x,-y) analytic, which is

symmetric with respect to the x-axis. The origin is a stable equilibrium; the Taylor series up to fourth order terms is given. Using a simple geometric argument and ordinary calculus, all families of symmetric librations which emanate from the equilibrium are determined. Points where special resonances occur are given, and behavior in the vicinity of resonance is analyzed. Moreover, the periods and stability index of several families are studied. The results are then applied to a specific spring-pendulum system. Finally, a numerical method to continue the families of librations away from the equilibrium is presented and applied to the spring-pendulum system. Dissert. Abstr.

N76-28949*# Princeton Univ., N.J.
COMBUSTION CONTRIBUTION TO NOISE IN JET ENGINES
E. G. Plett, A. N. Abdelhamid, D. T. Harrje, and M. Summerfield
Washington NASA Jul. 1976 42 p refs
(Grant NGR-31-001-241)
(NASA-CR-2704; Rept-1146) Avail: NTIS HC $4.00 CSCL 20A

The relative importance of combustion as a source of noise in a flow regime representative of a subsonic jet engine exhaust was investigated. The combustion noise source characteristics were obtained from pressure and temperature fluctuation measurements in the combustor and exhaust nozzle. The similarity between the fluctuations in this source region and the far field noise were compared. In the jet exhaust velocity range between 450 and 660 ft/sec investigated in detail, the frequencies of dominant pressure and temperature fluctuations in the combustor were also the frequencies of the dominant far field noise. The overall noise levels were 14 to 20 dB higher than from a corresponding clean jet in the same velocity range. Thus it seemed clear that the unsteadiness associated with the combustion process was responsible for the dominant noise in the far field. A simple analysis to predict the far field noise due to the internal pressure fluctuations causing exit plane velocity fluctuations produced trends closely resembling the measured results, but under predicted the far field noise over the spectral range examined. The possible reason for the higher far field noise is direct transmission of acoustic waves through the nozzle, which was not accounted for in the prediction scheme. Author

N76-28950*# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
SPACE SHUTTLE ELECTROMAGNETIC ENVIRONMENT EXPERIMENT. PHASE A: DEFINITION STUDY Final Report, 3 Sep. 1974 - 30 Sep. 1975
Fred Haber, R. M. Showers, C. Kocher, and L. A. Forrest, Jr.
Washington NASA Jun. 1976 177 p refs
(Contract NAS5-20707)
(NASA-CR-2707; Rept-76-03) Avail: NTIS HC $7.50 CSCL 20N

Methods for carrying out measurements of earth electromagnetic environment using the space shuttle as a measurement system platform are herein reported. The goal is to provide means for mapping intentional and nonintentional emitters on earth in the frequency range 0.4 to 40 GHz. A survey was made of known emitters using available data from national and international regulatory agencies, and from industry sources. The spatial distribution of sources, power levels, frequencies, degree of frequency re-use, etc., found in the survey, are here presented. A concept is developed for scanning the earth using a directive antenna whose beam is made to rotate at a fixed angle relative to the nadir; the illuminated area swept by the beam is of the form of cycloidal annulus over a sphere. During the beam's sojourn over a point, the receiver sweeps in frequency over ranges in the order of octave width using sweeping filter bandwidths sufficient to give stable readings. Author

N76-28951# Harry Diamond Labs., Adelphi, Md.
DIFFERENT REPRESENTATIONS OF DYADIC GREEN'S FUNCTIONS FOR A RECTANGULAR CAVITY
Chen-To Tai Dec. 1975 17 p refs
(DA Proj. 1W1-62118-AH-75)
(AD-A020865; HDL-TR-1724) Avail: NTIS CSCL 20/3

Several different, but equivalent, expressions of the dyadic Green's functions for a rectangular cavity have been derived and tabulated in this report. The mathematical relations between the dyadic Green's function of the vector potential type and that of the electric type are shown in detail. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-28952 Utah Univ., Salt Lake City.
ACOUSTIC SIGNAL PROCESSING BASED ON THE SHORT-TIME SPECTRUM Ph.D. Thesis
Michael Wayne Callahan 1976 86 p
Avail: Univ. Microfilms Order No. 76-15574

A new approach to acoustic signal processing is investigated based on the short-time Fourier transform, a two dimensional representation which shows the time and frequency structure of sounds. This representation is appropriate for signals such as speech and music, where the natural frequencies of the source change and timing of these changes are important to perception. The principal advantage of this approach is that the signal processing domain is similar to the perceptual domain, so that signal modifications can be related to perceptual criteria. The mathematical basis for this type of processing is developed, and four examples are described: removal of broad band background noise, isolation of perceptually important speech features, dynamic range compression and expansion, and removal of locally periodic interfering signals. Dissert. Abstr.

N76-28953 Minnesota Univ., Minneapolis.
STUDIES OF IMPULSIVE SOUND LEVEL RESPONSE STATISTICS IN A REVERBERANT ENCLOSURE Ph.D. Thesis
Egons Karl Dunens 1975 139 p
Avail: Univ. Microfilms Order No. 76-14886

Many industrial noise sources exhibit strong impulse behavior and operate in a reverberant environment. The sound pressure response to this type of source is not adequately described by steady-state formulations when the responses to successive noise impulses are nonoverlapping. Therefore, a simple, analytical model, based on the sound pressure response to an impulse sound source operating in a reverberant enclosure, was developed. In the reverberent enclosure the influence of the pressure response, the source-microphone location, the amount and placement of sound absorbing material, and the shielding by barriers were studied. A spark gap served as the impulse sound source. Two relevant sound pressure response parameters were considered in the development of the model. They are: (1) the root-mean-square sound pressure and (2) the sound pressure level exceedance probability distribution. It was concluded that the information generated by this model can be used to evaluate noise exposure times in an industrial environment. Dissert. Abstr.

N76-28954 Brown Univ., Providence, R.I.
SELECTIVE SPATIAL AND SPECTRAL ADAPTIVE PROCESSING OF THE ACOUSTIC FIELD Ph.D. Thesis
Salvatore Domenic Morgera 1975 246 p
Avail: Univ. Microfilms Order No. 76-15674

Spatial and spectral adaptive processing of the acoustic interference noise field encountered in active sonar operation is treated. The work involves the application of concepts drawn from the fields of linear statistical interference, pattern recognition, fading dispersive diversity communication, and adaptive optimization to a practical problem. The performance of a fully adaptive linearly constrained gradient search processor that adjusts the impulse responses of filters applied to each sensor output of an acoustic array is examined under the assumptions that the target field is known a priori and the interference field is completely unknown. It is shown that the fully adaptive processor parameters may not be well suited to the demands of active sonar detection. To arrive at a more fitting processor structure, a general characterization of the interference noise field covariance is developed which reveals only those significant spatial and spectral features. Dissert. Abstr.

N76-28955 California Univ., Berkeley.
EXCITATION OF HIGH-FREQUENCY ACOUSTIC WAVES BY TRAVELING HIGH-FIELD DOMAINS Ph.D. Thesis
Robert Edward Lee 1975 153 p
Avail: Univ. Microfilms Order No. 76-15276

Transduction of bulk and surface acoustic waves has been accomplished by coupling a Gunn effect oscillator to a piezoelectric crystal. Coupling between the high electric fields, associated with the traveling space charge domain in the Gunn oscillator, and the resulting stress concentration in the adjacent piezoelectric causes acoustic waves to be radiated both into and along the piezoelectric's surface. Energy is excited predominantly at the transit time frequency of the oscillator so that high frequency operation is inherent to this device. One feature of this novel transducer is its ability to convert dc electrical energy directly to RF acoustic energy, thereby eliminating the need for a separate RF source to drive it. Dissert. Abstr.

N76-28956 Rochester Univ., N.Y.
PHENOMENOLOGICAL CHARACTERIZATION OF TRANSMISSION-REFLECTION PROCESSES IN DIAGNOSTIC ULTRASOUND Ph.D. Thesis
Tesleem Iyiola Raji 1975 243 p
Avail: Univ. Microfilms Order No. 76-14778

A phenomenological model for transmission and reflection processes in diagnostic ultrasound was developed. The model accounts for signal distortion resulting from transmission, the time stretching effects of motion and the statistical nature of the reflection process. Propagation paths through an illuminated medium are interpreted as fixed, dispersive linear networks while the reflecting target is viewed as an ensemble of point scatterers of the incident radiation. Computer simulations of model projections for the transmission process, the combined transmission-reflection process and the results of correlation processing of the received wave-form are presented for a rectangular pulse, a Gaussian pulse and a pseudorandom sequence of pulses. It was concluded that the model created to characterize path transmission and reflection effects is useful to obtain quantitative descriptions of transmission distortion, to evaluate the performance of receiver structures, and to produce analysis of complicated transmission-reflection configurations. Dissert. Abstr.

N76-28957*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRFRAME SELF-NOISE: FOUR YEARS OF RESEARCH
Jay C. Hardin Jul. 1976 73 p refs
(NASA-TM-X-73908) Avail: NTIS HC $4.50 CSCL 20A

A critical assessment of the state of the art in airframe self-noise is presented. Full-scale data on the intensity, spectra and directivity of this noise source are evaluated in the light of the comprehensive theory developed by Ffowcs-Williams and Hawkins. Vibration of panels on commercial aircraft is identified as a possible additional source of airframe noise. The present understanding and methods for prediction of other component sources - airfoils, struts, and cavities - are discussed, and areas for further research as well as potential methods for airframe noise reduction are identified. Finally, the various experimental methods which have been developed for airframe noise research are discussed and sample results are presented. Author

N76-28958*# Systems Research Labs., Inc., Newport News, Va. RASA Div.
PARAMETRIC STUDY OF THE NOISE PRODUCED BY THE INTERACTION OF THE MAIN ROTOR WAKE WITH THE TAIL ROTOR
John C. Balcerak [1976] 70 p refs
(Contract NAS1-13690)
(NASA-CR-145001) Avail: NTIS HC $4.50 CSCL 20A

A model was designed, fabricated and wind tunnel tested to identify some of the parameters which were pertinent to the noise produced by the interaction of the main rotor wake with the tail rotor. The model provided for variations in many geometric and operating parameters. The initial set of tests indicated that the noise produced by the tail rotor was, in general, sensitive to the location of the vortex interaction on the tail rotor disk, direction of rotation, lateral rotor fin spacing, tip speed and the operating mode of the tail rotor; and generally insensitive to main rotor thrust coefficient, longitudinal spacing and tail rotor to main rotor rotational speed ratios. Refinements in the analyses to adequately predict the noise phenomenon have been outlined to complement further experimental investigations. Author

N76-28959*# Tennessee Univ., Knoxville.
NOISE SUPPRESSION WITH HIGH MACH NUMBER INLETS
Edward Lumsdaine, Jenn G. Cherng, and Ismail Tag Washington NASA Jul. 1976 108 p refs
(NASA-CR-2708) Avail: NTIS HC $5.50 CSCL 20A

Experimental results were obtained for two types of high Mach number inlets, one with a translating centerbody and a fixed geometry inlet (collapsing cowl) with no centerbody. The aerodynamic and acoustic performance of these inlets was examined. The effects of area ratio, length/diameter ratio, and lip geometry were among several parameters investigated. The translating centerbody type inlet was found to be superior to the collapsing cowl both acoustically and aerodynamically, particularly for area ratios greater than 1.5. Comparison of length/diameter ratio and area ratio effects on performance near choked flow showed the latter to be more significant. Also, greater high frequency noise attenuation was achieved by increasing Mach number from low to high subsonic values. Author

N76-28960*# Boeing Commercial Airplane Co., Seattle, Wash.
EFFECTS OF MOTION ON JET EXHAUST NOISE FROM AIRCRAFT Final Report
K. S. Chun, C. H. Berman, and S. J. Cowan Washington NASA Jun. 1976 221 p refs
(Contract NAS3-18539)
(NASA-CR-2701; D6-41995) Avail: NTIS HC $7.75 CSCL 20A

The various problems involved in the evaluation of the jet noise field prevailing between an observer on the ground and an aircraft in flight in a typical takeoff or landing approach pattern were studied. Areas examined include: (1) literature survey and preliminary investigation, (2) propagation effects, (3) source alteration effects, and (4) investigation of verification techniques. Sixteen problem areas were identified and studied. Six follow-up programs were recommended for further work. The results and the proposed follow-on programs provide a practical general technique for predicting flyover jet noise for conventional jet nozzles. Author

N76-28961*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
LANDING GEAR AND CAVITY NOISE PREDICTION
Donald B. Bliss and Richard E. Hayden Washington NASA Jul. 1976 57 p refs
(NASA Order L-18051-A)
(NASA-CR-2714) Avail: NTIS HC $4.50 CSCL 20A

Prediction of airframe noise radiation from the landing gear and wheel wells of commercial aircraft is examined. Measurements of these components on typical aircraft are presented and potential noise sources identified. Semiempirical expressions for the sound generation by these sources are developed from available experimental data and theoretical analyses. These expressions are employed to estimate the noise radiation from the landing gear and wheel wells for a typical aircraft and to rank order the component sources. Author

N76-28962*# New York Univ., N.Y. Div. of Applied Science.
SONIC BOOM RESEARCH Progress Report, 1 May - 31 Jul. 1976
Victor Zakkay and Lu Ting 31 Jul. 1976 15 p refs
(Grant NGL-33-016-119)
(NASA-CR-148548) Avail: NTIS HC $3.50 CSCL 20A

A computer program for CDC 6600 is developed for the nonlinear sonic boom analysis including the asymmetric effect of lift near the vertical plane of symmetry. The program is written in FORTRAN 4 language. This program carries out the numerical integration of the nonlinear governing equations from the input data at a finite distance from the airplane configuration at a flight altitude to yield the pressure signitude at ground. The required input data and the format for the output are described.

A complete program listing and a sample calculation are given.
Author

N76-28963# Washington Univ., St. Louis, Mo. Applied Physics Lab.
NOISE BARRIER SCREEN MEASUREMENTS: SINGLE BARRIERS
Rene N. Foss Jun. 1975 71 p ref Sponsored by DOT
(PB-250971/9; APL-UW-7509; Rept-24.1) Avail: NTIS HC $4.50 CSCL 13B

By exercising great care in the experimental procedures, the data spread was kept within a narrow band about 1 dB wide. The results of these experiments indicate that the correct attenuation curve (in decibels vs Fresnel number N) for a point source is given by Fresnel's equations. The results of calculations that convert this point source curve to the incoherent line source (and line source segment) case are also given. The measurements were conducted at two frequencies, 5.19 and 10.019 kHz, and employed a variety of source-to-wall and wall-to-microphone spacings. They were carried out indoors using pulse techniques to eliminate unwanted bounces and reflections. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-28964 Brown Univ., Providence, R.I.
MOLECULAR THEORY OF SURFACE TENSION Ph.D. Thesis
Arthur Jing-Min Yang 1975 98 p
Avail: Univ. Microfilms Order No. 76-15737

The calculus of variations is used for determination of the equilibrium distribution of the molecular density in a two-phase, one component system. The total Helmholtz free energy, to be minimized, is thus expressed as a definite integral. From analysis of the Euler-Lagrange differential equation general expressions are obtained for pressure and surface tension. Gravitational effects are obtained from the differential equation when an appropriate term is incorporated into the original Helmholtz free energy density. In a three dimensional treatment the stress tensor formula is obtained from the corresponding partial differential equation. A (differential) generalization of the Young-Laplace equation for the spherical interface is derived. In addition metastable regions are described and interpreted. The stress tensor for the system in the presence of any kind of conservative force field can also be obtained. Dissert. Abstr.

N76-28965 Massachusetts Univ., Amherst.
STATIC AND DYNAMIC STUDIES OF MOLECULAR ORIENTATION OF SEMICRYSTALLINE POLYETHYLENE Ph.D. Thesis
Su-Don Hong 1976 265 p
Avail: Univ. Microfilms Order No. 76-14647

Values of the anisotropy of polarizability of methylene groups deduced from the refractive indices of n-paraffin crystals differ appreciably from those obtained from gas or liquid phase measurements. The differences are attributed to the erroneous application of the Lorenz-Lorentz internal field to the anisotropic crystal. A detailed calculation of the internal field was carried out by summation of the dipolar field over an idealized n-paraffin crystal in which the molecular chains were replaced by anisotropic rods. Based upon reasonable values of parameters and assumed crystal shape, the discrepancy in polarizability anisotropy was resolved. Segment polarizability anisotropy was obtained from stress-optical coefficients, for both undiluted rubber networks and diluted rubber networks, and is discussed with regard to recent theories. The relationship between the molecular orientation and stress-strain relationship of polyethylenes having different morphologies was investigated. In particular, the molecular orientation for quenched low density polyethylene during and after rapid stretching was studied, using infrared dichroism and birefringence techniques. It was concluded that molecular orientation was not associated with stress relaxation. Various mechanisms of stress relaxation were also discussed.
Dissert. Abstr.

N76-28966 California Univ., Berkeley.
ADVANCES IN THE SOLUTION OF THE ELECTRONIC SCHROEDINGER EQUATION FOR MODERATELY SYMMETRIC OPEN SHELL MOLECULES Ph.D. Thesis
David Roy Yarkony 1975 114 p
Avail: Univ. Microfilms Order No. 76-15433

The extension of self consistent field formalism to moderately symmetric open shell molecules is investigated. In particular the failure of standard Fock operator procedures to handle electronic states arising from the orbital occupancy 1e sub3 2e (C sub 3v symmetry) is investigated. An alternative procedure for handling these states, based on an appropriate generalization of Brillouin's theorem, is subsequently developed. This procedure, termed the Symmetry-Adapted Annihilation of Single-Excitations (SAAS) procedure, has the advantage of being easily extended to the multiconfiguration self consistent field problem. The SAAS procedure is then exploited to investigate the excited electronic states of methyl cyanide and methyl isocyanide. Also discussed is the use of the theory of group representations to construct appropriately symmetrized wave functions for use in a configuration interaction calculation when the spatial point group of the molecule in question is non-Abelian. A computer algorithm for realizing this method is discussed briefly. Dissert. Abstr.

N76-28967 California Univ., Berkeley.
MOLECULAR BEAM KINETICS Ph.D. Thesis
Richard Behrens, Jr. 1975 309 p
Avail: Univ. Microfilms Order No. 76-15108

The design of a crossed molecular beam supermachine for neutral-neutral collisions is discussed. The universal electron bombardment ionizer, mass filter, and ion detection system of the detector, the supersonic nozzle sources, the differential pumping arrangement for the sources and detector, the time-of-flight detection of scattered products, and the overall configuration of the apparatus are described. The elastic scattering of two systems, CH4 + Ar and NH3 + Ar, have been measured using the supermachine with two supersonic nozzle sources. The rainbow structure and the interference oscillations are seen in each system. The best fit to the data was found using a Morse-Spline-Van der Waals (MSV) potential. Dissert. Abstr.

N76-28968 California Univ., Berkeley.
COHERENCE IN MULTILEVEL SYSTEMS Ph.D. Thesis
William George Breiland 1975 176 p
Avail: Univ. Microfilms Order No. 76-15121

Mathematical descriptions of an excited state multilevel system are developed to include progressively the effects of coherent coupling, feeding, decay and relaxation, and the expressions are illustrated with several pulse coherence experiments utilizing zero field optically detected magnetic resonance of excited triplet states. Dissert. Abstr.

N76-28969 Minnesota Univ., Minneapolis.
USE OF CLASSICAL AND SEMICLASSICAL APPROXIMATIONS IN ATOM-DIATOMIC MOLECULE SCATTERING CALCULATIONS Ph.D. Thesis
James William Duff 1975 163 p
Avail: Univ. Microfilms Order No. 76-14885

In Part One several classical trajectory and classical S matrixs approximations for the calculation of transition probabilities in nonreactive and reactive collisions of atoms with diatomic molecules are tested against quantum mechanical calculations for collinear collisions involving model potentials. In Part Two some of these methods are applied to study the sensitivity of vibrational energy transfer in nonreactive collisions and specificity of vibrational energy release and selectivity of vibrational energy utilization in chemical reactions to the details of realistic potential energy surfaces. Dissert. Abstr.

N76-28970 Cornell Univ., Ithaca, N.Y.
A FRAGMENT MOLECULAR ORBITAL ANALYSIS OF BONDING IN TRANSITION METAL COMPLEXES AND THEORETICAL ASPECTS OF BONDING SUBSTITUENT SITE PREFERENCES, GEOMETRICAL DISTORTIONS IN SULFURANES Ph.D. Thesis

Maynard Ming-Liang Chen 1976 176 p
Avail: Univ. Microfilms Order No. 76-14846

Molecular orbitals generated by extended Huckel calculations are used to predict the structure and chemistry of inorganic compounds. A fragment molecular orbital basis was used to analyze the bonding of transition metal complexes. Specific conclusions are summarized for sulfuranes, pentacoordinate nitrosyls, diatomic ligands in transition metal complexes, transition metal carbenoid complexes, and for comparative bonding of conical fragments. Dissert. Abstr.

N76-28971 Rochester Univ., N.Y.
SUPERRADIANCE IN AN INHOMOGENEOUSLY BROADENED ATOMIC SYSTEM Ph.D. Thesis
Ronald Eugene Jodoin 1976 120 p
Avail: Univ. Microfilms Order No. 76-14764

The problem of cooperative spontaneous emission from an inhomogeneously broadened system of N two level atoms is treated. The semiclassical approach is justified for a sufficiently large atomic system. The basic calculation of superradiance due to Dicke is outlined, and numerous subsequent treatments are cited. Also discussed are a few experiments in which superradiant effects have reportedly been observed. The problem of the time evolution of the system is formulated in terms of the Bloch vector respresentation derived from the coupled Maxwell-Schrodinger equations, where the coupling occurs between the atomic transition dipole moments and the classical electromagnetic field. Coupled integrodifferential equations of motion for the Bloch vector components are found with the assumption that all atoms see the same electromagnetic field and are contained in a region smaller than an optical wavelength. The limiting case of negligible cooperation among atoms is studied to obtain a general solution for free induction decay. Dissert. Abstr.

N76-28972 Texas Univ., Austin.
NEUTRON SPECTRA FROM 647 AND 800 MeV PROTON BOMBARDMENT OF HYDROGEN AND DEUTERIUM Ph.D. Thesis
Christopher Wayne Bjork 1975 243 p
Avail: Univ. Microfilms Order No. 76-14418

Zero degree neutron spectra for the inclusive reactions p(p,n) and d(p,n) were obtained with the aid of a multiwire proportional chamber spectrometer which momentum analyzed charged particles produced in a liquid hydrogen radiator target in the zero degree neutron beam. Spectra were obtained for bombarding proton kinetic energies of 647 and 800 MeV. The primary targets were liquid hydrogen and liquid deuterium. The spectra were corrected for inelasticity in the hydrogen radiator target upstream of the spectrometer. Neutron momenta were measured to as low a value as 385 MeV/c. The cross sections were normalized by the n-p charge exchange elastic cross sections and by the primary proton flux as measured by a toroid current monitor.
Dissert. Abstr.

N76-28973 Rutgers Univ., New Brunswick, N.J.
NUCLEAR MAGNETIC POLARIZATION AT LOW FIELD Ph.D. Thesis
Ann Grant Goetz 1976 136 p
Avail: Univ. Microfilms Order No. 76-16399

Separate research projects with the unifying theme of nuclear magnetic polarization are described. The current theory of chemically induced dynamic nuclear polarization as it applies at low magnetic fields is reviewed and discussed. The polarization resulting from the decomposition of benzoyl peroxide in two solvents, cyclohexanone and perchloracetone, was studied as a function of field. The samples were thermolyzed in the probe of a low field spectrometer and the proton nmr enhancement were recorded directly. A quartet of phosphoryl compounds and their thiophosphoryl analogs were studied by the dynamic nuclear polarization technique. Two different radicals, bisdiphenylene phenyl allyl and perchlorotriphenyl methyl, were used to polarize the phosphorus nuclei of the solvent. Dissert. Abstr.

N76-28974 Minnesota Univ., Minneapolis.
INFRARED LIQUID ARGON SOLUTION SPECTRA AND FORCE FIELDS FOR POLYATOMIC MOLECULES Ph.D. Thesis
Anthony Charles Jeannote, II 1975 158 p
Avail: Univ. Microfilms Order No. 76-14910

Experimental facilities were developed for the measurement of infrared spectra of simple molecules in liquid-argon solution. The spectra of CF4, NF3, and OCS were measured and analyzed. In liquid-argon solution the rotational fine structure was suppressed and each vibrational transition appeared as a single discrete spectral feature; the determination of the wave-number of the transition and the vibrational assignment was relatively straightforward. Arharmonic force field adjustments were carried out for CF4, NF3, and OCS, but the results of these calculations were complete only for OCS. In that case, it was found that the liquid-argon solution vibrational data, when combined with the rotational constants obtained from gas-phase measurements, formed a useful data base to which the quartic force field of OCS could be adjusted. The force fields determined in this way were found to be in good agreement with gas-phase results.
Dissert. Abstr.

N76-28975 Georgia Inst. of Tech., Atlanta.
OPTICAL INVESTIGATION OF ION-METAL COLLISIONS Ph.D. Thesis
William E. Baird, Jr. 1975 111 p
Avail: Univ. Microfilms Order No. 76-15595

Impact of 10 to 30 KeV H(+) or He(+) ions on polycrystalline metal surfaces causes some projectiles to be backscattered in a neutral, excited state. These projectiles subsequently radiatively decay, emitting Doppler broadened spectral lines; the broadening is characteristic of the distribution in speeds and direction of the scattered excited projectiles. Analysis of the line shape shows that slow reflected particles have a high probability of losing the excited electron by a radiationless transition while they are close to the surface. The spectral line shape has been predicted using an established backscattering theory with the inclusion of a radiationless de-excitation term. By suitable choice of the radiationless de-excitation coefficient, the prediction may be fitted to the experimental data; thus the radiationless de-excitation coefficient may be determined. Dissert. Abstr.

N76-28976 Rochester Univ., N.Y.
NONLINEAR THEORY OF THE COLLISIONLESS DRIFT INSTABILITY Ph.D. Thesis
Leonard Saul Gross 1976 117 p
Avail: Univ. Microfilms Order No. 76-14759

The nonlinear threshold behavior of the density driven collisionless drift instability was studied. This is accomplished by extending the work of Simon and Rosenbluth to the case of an inhomogeneous magnetized plasma. It is necessary to reformulate linear theory so as to incorporate finite geometry and clearly establish a neutral stable point. The analogues of the Case-Van Kampen normal modes must also be examined. A number of indeterminacies are resolved and then the nonlinear modifications of both the electron and ion distribution functions are obtained. From these one is able to calculate the limiting amplitude and frequency shift of the linearly unstable wave. A new small amplitude oscillating state is found. However, this state is itself unstable to small perturbations and hence cannot be experimentally observed. Instead the plasma moves explosively to a new state when the instability threshold is surpassed.
Dissert. Abstr.

N76-28977 California Univ., Berkeley.
VIBRATIONAL INELASTICITY IN H2 COLLISIONS WITH He AND Li(+) Ph.D. Thesis
Andrew Wesley Raczkowski 1975 127 p
Avail: Univ. Microfilms Order No. 76-15348

The partially averaged version of classical S-matrix theory was applied to three-dimensional collisions of H2 with He and Li (+). For H2-Li(+) cross-sections for the de-excitation of H2 from (n sub 1, j sub 1) = (1,0) to the ground vibrational manifold were computed at a total energy of 1.2 eV and compared to previously done coupled channel calculations of Schaefer and Lester. The agreement is very good. For comparision, coupled channel calculations were also performed on the system at the same energies. The agreement was poorer than in the H2-Li(+) case, for identifiable reasons. The cross-sections were used to compute rate constants and relaxation times for the H2-He system. Comparison of these results with the results of experiment and of other calculations shows good agreement. Dissert. Abstr.

N76-28978 California Univ., Berkeley.
POLAR HYDROGEN SCATTERING FACTORS IN X-RAY DIFFRACTION ANALYSIS Ph.D. Thesis
Arthur Jules Olson 1975 189 p
Avail: Univ. Microfilms Order No. 76-15327

An ab initio method of modeling bond specific hydrogen electron density and producing polar hydrogen X-ray scattering factors is described. Calculations involving several different wavefunction representations of the water molcule have been carried out using a variety of computational parameters. Computer programs have been developed and reported for: (1) the calculation and manipulation of Gaussian and Slater based electron density functions; (2) the analytical Fourier inversion of a general and cylindrically symmetric Gaussian based electron density distributions; (3) the numerical Fourier inversion of a cylindrically symmetric table of electron density values. In the methods outlined, computational parameters and choices have been selected and reported for use in the defined procedures. Also, certain minimum criteria for the selection of wavefunctions have been established. A summary of calculations has been reported and their results have been compared among themselves and with X-ray and neutron data on sucrose, descriptive of the O-H bond. The scattering factors have been produced indicate neither complete success nor complete failure of the method. Dissert. Abstr.

N76-28979 Wisconsin Univ., Madison.
NEUTRAL ATOM AND NEGATIVE HYDROGEN ION PRODUCTION WITH A HALL ACCELERATOR Ph.D. Thesis
James Henry Kamperschroer 1976 216 p
Avail: Univ. Microfilms Order No. 76-10664

A Hall accelerator was studied with the objective in mind of injecting its output into a cesium charge exchange cell and producing negative ions. Operation of the high current Hall accelerator resulted in the observation of an ionizational instability. Elimination of this instability is possible in one of two ways. Either the arc current can be decreased to a very low level or an extension can be placed in front of the anode and the arc current increased to such a value that the mean free path for ionization is approximately equal to the separation between this extension and the anode. This latter method preionizes the gas before it enters the accelerating stages. High current operation also results in the predominant number of particles ejected from the source being neutral. Two possible explanations are set forth to describe the large flux of neutral particles observed. Two mechanisms are hypothesized to describe the large negative ion fractions observed with the magnetic field off. Dissert. Abstr.

N76-28980*# Paine Coll., Augusta, Ga.
INELASTIC SCATTERING OF 61 MeV PROTONS BY PB-207 Final Report, 1 Sep. 1975 - 31 Jul. 1976
Muhammad Owais Jul. 1976 48 p refs
(Grant NsG-8002)
(NASA-CR-148531; PC-NAS-004) Avail: NTIS HC $4.00 CSCL 20H

Differential cross sections for the excitation of the first four neutron-hole states and the doublet at 2.61 MeV by 61.2 MeV protons were measured. The data are analyzed in terms of both a purely collective model description and a microscopic model supplemented by macroscopic core polarization. A realistic two-body interaction is used and knock-on amplitudes are included. Core polarization is found to be important but represents a relatively smaller contribution than in most nuclei previously studied. A parallel analysis of similar data at lower proton bombarding energies reveals a surprisingly strong energy dependence of the reaction mechanisms. Author

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-28981 California Univ., Berkeley.
MASS MEASUREMENTS OF HIGHLY NEUTRON-EXCESS NUCLEI IN THE LIGHT ELEMENTS Ph.D. Thesis
Kenneth Hugh Wilcox 1975 102 p
Avail: Univ. Microfilms Order No. 76-15446

The Mg-26(Li-7,B-9)Ne-25 reaction at 78.9 MeV was used to measure the mass excess Ne-25(-2.18 + or - 0.10 MeV) and several low lying excited states. Mass excesses for Ar-43(-31.98 + or - 0.07 MeV), Ar-45(-29.727 + or - 0.06 MeV), and Ar-46(-29.732 + or - 0.07 MeV) were determined from Ca-48(alpha, Be-9,-7)Ar-43,-45 reactions at 77.7 MeV and the Ca-48(Li-6,B-8)Ar-46 reaction at 80.1 MeV. Several excited states of Ar-43 and Ar-45 were observed. These and the excited states of Ne-25 are compared with theoretical predictions. Ground state differential cross sections are given for all reactions, ranging from 0.1 to 1 micron b/sr at forward angles. Upper limits of about 1 to 25 nb/sr were determined for the ground state cross sections of the reactions Ca-48(alpha, B-8,-10,-11)Cl-44, 42,-41 and Ca-48(alpha,C-(10-13)S-(42-39)) at 110 MeV.
Dissert. Abstr.

N76-28982 Rochester Univ., N.Y.
COUPLED EQUATIONS METHOD FOR PION SCATTERING FROM THE TWO-NUCLEON SYSTEM Ph.D. Thesis
Tetsuro Mizutani 1976 272 p
Avail: Univ. Microfilms Order No. 76-14771

An attempt is made to clarify the structure of pion-nucleus scattering taking into account the fact that the pions in scattering and in nuclear forces are identical. To understand the essential points, a simple pion plus two-nucleon system was chosen for study. Both relativistic and non relativistic approaches were adopted. In the relativistic approach Taylor's method was used, whereas in the non relativistic approach a Hamiltonian (Schrodinger equation) method was utilized together with a projection technique. Both approaches give a finite set of amplitude equations respectively, and the formal correspondence between these sets of equations was observed. Due to the proper consideration of pions, the problem of pion overcounting does not occur and the amplitudes are shown to satisfy at least two- and three-particle unitarity. Several important aspects common in general pion-nucleus scattering have been observed, which would bot be possible through commonly used approaches in the study of pi-nucleus interactions. Some possible future applications of the formulations developed are discussed. Dissert. Abstr.

N76-28983 Rochester Univ., N.Y.
SPECTRAL AVERAGING METHODS IN NUCLEAR PHYSICS Ph.D. Thesis
Vijay Narayan Potbhare 1976 184 p
Avail: Univ. Microfilms Order No. 76-14776

Spectral averaging methods were developed for spectroscopic problems in large shell-model spaces. The methods utilize the state density and various parametric derivatives which measure the response of the system as the Hamiltonian is perturbed in various ways. The state density itself determines the spectrum while expectation values of operators and strength distributions for various excitations can be determined from the parametric derivatives. The state density and partial state densities of the system also determine sets of orthogonal polynomials which are used to obtain rapidly convergent expansions for the statistically-smoothed expectation values and strength distributions. The state density, and hence the orthogonal polynomials, are determined by the density moments, traces of powers of the Hamiltonian. The parametric derivatives are then given in terms of traces of operators multiplied by powers of H. A diagrammatic technique for evaluation of the low-order traces directly in terms of the defining matrix elements is discussed. Dissert. Abstr.

N76-28984 California Univ., Berkeley.
APPLICATIONS OF GENERALIZED CLASSICAL TRAJECTORIES IN NUCLEAR PHYSICS Ph.D. Thesis
Herbert Massman Leser 1975 194 p
Avail: Univ. Microfilms Order No. 76-15329

A method known as the uniform semiclassical approximation is described briefly and then applied to two nuclear physics problems. The dynamics of the problem are treated completely classically (that is, one solves classical equations of motion),

but the quantum mechanical superposition principle is retained by evaluating a phase along the classical trajectory and adding probability amplitudes for indistinguishable processes rather than probabilities themselves. The backscattering from a deformed nucleus and the excitation of rotational states in the target at energies up to the Coulomb barrier are first analyzed. A nuclear optical potential is also considered, and the nuclear Coulomb interference for heavy ions is studied. In addition, the problem of tunneling through a two-dimensional barrier is investigated by a fully quantum-mechanical coupled-channel calculation and by the uniform semiclassical approximation. A quantitative agreement is found. Dissert. Abstr.

N76-28985 Illinois Univ., Urbana.
ENERGY DISTRIBUTIONS OF ELECTRONS IN ELECTRON BEAM PRODUCED NITROGEN PLASMAS Ph.D. Thesis
Dennis Ray Suhre 1976 72 p
Avail: Univ. Microfilms Order No. 76-16204

A theory is developed which predicts the equilibrium electron energy distributions resulting from the injection of an electron beam into molecular nitrogen. The results are highly non-Maxwellian with a depletion region existing near 2.5 eV. Using these distributions, fractional power transfers to various excitation processes were calculated. The theory was verified experimentally by using Langmuir probes to measure the electron energy distributions produced by a beam generated by a cold cathode discharge in low pressure nitrogen. The distributions were measured in absolute units and compared directly with theory. All of the major features of the theory were found to be present in the measurements. Dissert. Abstr.

N76-28986 California Univ., Berkeley.
THE EFFECT OF FREE-PARTICLE COLLISIONS IN HIGH ENERGY PROTON AND PION-INDUCED NUCLEAR REACTIONS Ph.D. Thesis
Norman Peara Jacob, Jr. 1975 183 p
Avail: Univ. Microfilms Order No. 76-15233

The effect of free-particle collisions in simple 'knockout' reactions of the form (a,aN) and in more complex nuclear reactions of the form (a,X) was investigated in a two part study by using protons and pions as the incident projectiles. In the first part of this study, cross sections for the Ti-48(p,2p), Sc47, and the Ge-74(p,2p), Ga-73 reactions were measured from 0.3 to 4.6 GeV incident proton energy. The results indicate a rise in (p,2p) cross section for each reaction of about (25 + or - 3) percent between the energies 0.3 and 1.0 GeV and are correlated to a large increase in the total free-particle pp scattering cross sections over the same energy region. In the second part of the study, cross section measurements for more complex pion-induced spallation reactions were measured for the light target nuclei N-14, O-16 and F-19 from 45 to 550 incident pion energy. Experimental results were compared to previous pion and analogous proton-induced reactions, to Monte Carlo intranuclear cascade-evaporation calculations, and to a semi-classical nucleon charge exchange model in an effort to understand the mechanism of pion reactions. Dissert. Abstr.

N76-28987 California Univ., Berkeley.
STRONG TURBULENCE AND THE ANOMALOUS LENGTH OF STORED PARTICLE BEAMS Ph.D. Thesis
Paul Jackson Channell 1975 102 p
Avail: Univ. Microfilms Order No. 76-15441

A theoretical analysis is made of the longitudinal stability of intense beams of charged particles in high energy storage rings. The effect of externally applied radio frequency fields, i.e., synchrotron oscillations, is included. For electron and positron beams, the damping and quantum excitation due to particle radiation are also included. A criterion for the stability of small longitudinal plasma oscillations is derived and used to obtain the stable size of intense stored beams of electrons and positrons. Dissert. Abstr.

N76-28988 California Univ., Berkeley.
QUANTUM ELECTRODYNAMICS WITH THE SPEAR MAGNETIC DETECTOR Ph.D. Thesis
John Edward Zipse 1975 160 p
Avail: Univ. Microfilms Order No. 76-15437

The experiment performed by the SLAC-LBL collaboration and the results concerning the strong interaction are described. Then the interactions e(+)e(-) yields e(+)e(-) and e(+)e(-) yields positive micron negative micron are considered along with their third-order radiative corrections. These events, previously used to determine new limits for cutoff parameters in QED breakdown models, are further studied in this work to show that the full distribution in coplanarity angle fits the theoretical prediction well. The major focus of this work is on the fourth order two photon process, e(+)e(-) yields e(+)e(-)A(+)A(-), which only recently was realized to be significant in such experiments. Cross sections are derived and calculated exactly for this process and the results compared to a Weizacker-Williams equivalent photon calculation. The two-photon data is then isolated and fit to the calculation. Dissert. Abstr.

N76-28989*# Rasor Associates, Inc., Sunnyvale, Calif.
ADVANCED THERMIONIC ENERGY CONVERSION Progress Report, 1 Sep. 1973 - 31 Aug. 1974
E. J. Britt, G. D. Fitzpatrick, L. K. Hansen, and N. S. Rasor 1974 136 p refs Sponsored in part by NASA
(Contract AT(11-1)-2263)
(NASA-CR-148569; COD-2263-2; NSR-2-2) Avail: NTIS HC $10.00 CSCL 18K

Basic analytical and experimental exploration was conducted on several types of advanced thermionic energy converters, and preliminary analysis was performed on systems utilizing advanced converter performance. The Pt--Nb cylindrical diode which exhibited a suppressed arc drop, as described in the preceding report, was reassembled and the existence of the postulated hydrid mode of operation was tentatively confirmed. Initial data obtained on ignited and unignited triode operation in the demountable cesium vapor system essentially confirmed the design principles developed in earlier work, with a few exceptions. Three specific advanced converter concepts were selected as candidates for concentrated basic study and for practical evaluation in fixed-configuration converters. Test vehicles and test stands for these converters and a unique controlled-atmosphere station for converter assembly and processing were designed, and procurement was initiated. Dissert. Abstr.

N76-28990# Army Facilities Engineering Support Agency, Fort Belvoir, Va. Engineering Div.
MH-1A CORE 5 ASSEMBLY, ZERO POWER EXPERIMENT AND CORE PHYSICS TEST REPORT Final Report
John M. Bryson, II, Henry C. Gignilliat, Jr., and James W. Wagoner, II 26 Feb. 1975 56 p refs
(AD-A020548; ED-7509) Avail: NTIS CSCL 18/10

MH-1A Core 5 is the first batch-loaded core. This report contains a description of the refueling operation, the results of the Zero Power Experiment conducted on two prototype control rods, and the data and results of core physics testing. This entire operation was performed over a 9-week period beginning in late November 1974, and culminating at power operation on 3 February 1975. Core physics analysis contained herein includes comparisons where applicable between measured values of basic reactor parameters and those predicted in The Theoretical Nuclear Analysis of MH-1A Core 5. GRA

N76-28991# Harry Diamond Labs., Adelphi, Md.
TRANSIENT IONIZATION EFFECTS FROM PRIMARY GAMMA FISSION RADIATION IN THE UPPER ATMOSPHERE
John P. Roberts and John S. Wicklund Oct. 1975 47 p refs
(DA Proj. 1W1-62118-AD-51)
(AD-A020812; HDL-TR-1725) Avail: NTIS CSCL 18/8

Gamma-radiation transport at deep penetration distances in the atmosphere has been studied as a function of time for a fission gamma unit-impulse source at a 45-km altitude. The Monte Carlo calculation included altitude-dependent air density, curvature of the earth, and Rayleigh scattering and polarization of the photons. Data were obtained on energy, angle, and time distributions for 20 detector positions. The results show a large contribution to Compton ionization production rates at late (about 10 to 100 microseconds) local times due to the arrival of multiply scattered gamma rays. Maintaining an energy cutoff as low as 10 keV has shown a pronounced effect on the total ionization at some detector locations. The results cast some doubt on

the validity of previous calculations of gamma-induced atmospheric EMP. GRA

N76-28992# Rensselaer Polytechnic Inst., Troy, N.Y.
RADIOISOTOPE STUDY Final Report, 1 Mar. 1968 - 30 Sep. 1973
Heinrich A. Medicus Jul. 1975 6 p refs
(Contract N00014-68-C-0384; NR Proj. 024-217)
(AD-A020516) Avail: NTIS CSCL 18/6

Pig lead loaned by the U. S. Navy to the contractor was used for shielding in performing research projects in the area of Nuclear Physics. Ph.D. theses, Master's theses and technical papers resulted from experiments using the loaned lead.
Author (GRA)

N76-28993# New Technology, Inc., Huntsville, Ala.
IDENTIFICATION OF DYNAMIC CHARACTERISTICS OF NUCLEAR REACTOR SYSTEMS Final Report
Chun Hsu Jan. 1976 126 p refs Sponsored by Elec. Power Res. Inst.
(PB-251294/5; EPRI-302-1-FR) Avail: NTIS HC $6.00 CSCL 18I

The feasibility of applying the Randomdec Signature technique as a potential diagnostic tool in the detection and prediction of core structural damage due to vibration and wear was demonstrated. The existing NTI computer program was modified and extended for characterizing flow induced mechanical core vibrations from ex core neutron detection. Current reactor operating data corresponding to various phases of operation were used to demonstrate its feasibility and to establish analysis procedures for monitoring operating reactors. Author (GRA)

N76-28994# Brookhaven National Lab., Upton, N.Y.
IMPROVEMENT OF REFERENCE NUCLEAR DATA FOR COMMERCIAL POWER REACTOR ANALYSIS AND DESIGN Final Report
S. Pearlstein and W. Rothenstein Oct. 1975 68 p refs Sponsored by Elec. Power Res. Inst.
(PB-250764/8; EPRI-220-1-FR) Avail: NTIS HC $4.50 CSCL 18I

Improving the performance of the ENDF/B library in thermal reactor applications is discussed. The analysis and data testing capability was extended to thermal systems. Information on how the present version of the ENDF/B library is performing in thermal benchmark experiments was obtained. Author (GRA)

N76-28995# Nuclear Services Corp., Campbell, Calif.
GAMMA-RAY HEATING IN POWER REACTORS Final Report
A. P. Olson Jan. 1976 138 p refs Sponsored by Elec. Power Res. Inst.
(PB-250569/1; EPRI/TSA-16) Avail: NTIS HC $6.00 CSCL 18I

Gamma ray heating in commercial nuclear power reactors is investigated. Design methods, computer codes, data libraries, and experimental data are examined. Some recommendations are made as to extensions of existing methods and codes, and some new experiments. Author (GRA)

74 OPTICS

Includes light phenomena.

N76-28996 Case Western Reserve Univ., Cleveland, Ohio.
THE USE OF FLUORESCENCE IN MEASURING THE CIRCULAR DICHROISM OF OPTICALLY ACTIVE MATERIALS Ph.D. Thesis
Thomas Gaylord White 1975 137 p
Avail: Univ. Microfilms Order No. 76-16079

The circular dichroism of the exciting transition of an optically active fluorescent sample is measured from the information contained in the emitted fluorescence light. The information contained in the fluorescence light is shown to be highly dependent on the relationship of the optically active material and the fluorescent species in the sample. The output of the fluorescence experiment was shown to depend on the optical path length in the sample and the viewing arrangement of the cell if the viewing arrangement does not collect emitted light equally from all points on the exciting beam path. The effect of viewing location on the baseline for the fluorescent technique was considered and shown to be dependent on the accuracy of the modulator output. Experimental results on the chondroitin sulfate type A - acridine orange chemical system tend to confirm the theoretical models.
Dissert.Abstr.

N76-28997 State Univ. of New York, Stony Brook.
STUDIES OF DYNAMICS OF MACRO-MOLECULES IN SOLUTIONS BY QUASI-ELASTIC LIGHT SCATTERING Ph.D. Thesis
Fang-chung Chen 1976 244 p
Avail: Univ. Microfilms Order No. 76-14600

A versatile light scattering spectrometer was constructed to make digital photon counting and photon correlation measurements of angular and spectral distribution of Rayleigh light scattered by macromolecular solution. A range of different types of macro-molecules varying from suspensions of polystyrene latex spheres to very large and complex macro-molecules, such as calf-thymus DNA, were studied in solution. Aside from determinations of translational diffusion coefficients, and in some cases, the z-average translational diffusion of the macro-molecules, the effects of polydispersity and internal motions were examined using simple statistical models as well as the method of cumulants in the data fitting process for linewidth measurements. Zimm plots were also made from intensity data in order to determine the average molecular weight and, for large macro-molecules, the radius of gyration. Dissert. Abstr.

N76-28998 California Univ., Berkeley.
OPTICAL PROPERTIES OF SIMPLE FLUIDS, 1. MODE-COUPLING THEORY OF CRITICAL TRANSPORT, 2 Ph.D. Thesis
David William Oxtoby 1975 131 p
Avail: Univ. Microfilms Order No. 76-15331

Multiple light scattering by a simple fluid is first discussed. It is demonstrated that a direct perturbation approach to the multiple scattering series leads to term-by-term divergences, and a renormalization is conducted to eliminate them. The renormalized theory is then applied to a calculation of the depolarized light scattering intensity near the gas-liquid critical point, and the depolarization ratio is predicted to show a minimum in the critical region. Multiple polarized scattering near the critical point is also studied. A simple model is proposed for the calculation of pair polarizabilities for interacting closed shell atoms and molecules. A theory of the coupling of long-wavelength hydrodynamic modes near the critical point is then discussed. The mode coupling theory is used to predict the critical point behavior of the shear viscosity and the linewidth of the scattered light. The theory is then generalized to study fluctuations around a nonequilibrium steady state. Dissert. Abstr.

N76-28999 California Univ., Berkeley.
STUDY OF CURVED SURFACE WAVEGUIDES Ph.D. Thesis
Sang Keun Sheem 1975 121 p
Avail: Univ. Microfilms Order No. 76-15367

The characteristics and applications of the wave being guided by the homogeneous dielectric curved surfaces are studied. The effect is known as 'Whispering Gallery Modes'. The guiding characteristics of homogeneous cylindrical surfaces, single curved boundaries on thin dielectric films, and three-dimensional curved surfaces such as conic and spherical surfaces are examined.
Dissert. Abstr.

N76-29000 Cornell Univ., Ithaca, N.Y.
ELECTRO-OPTIC MODULATION IN THIN-FILM LIGHT-GUIDES Ph.D. Thesis
Yong-Kyung Lee 1975 89 p
Avail: Univ. Microfilms Order No. 76-15277

A lightguide structure consisting of isotropic Ta2O5 film on electro-optic LiTaO3 crystal was used in Bragg-diffraction type modulation and polarization conversion experiments. The deflection modulator was analyzed using coupled mode theory. Its power per bandwidth (PPW) factor depends on the capacitance and the electric field distribution of the interdigital structure, and

can be minimized by optimizing the parameters of the interdigital structure. The criteria for determining the electrode length were also derived requiring an extinction ratio or better than 30 db, uniformity of the electric field along the electrode, and proper branching of optical signals in integrated optical circuits. The Ta2O5 - LiTaO3 deflection modulator demonstrated a 90% deflection when 34 V was applied, and had a PPW factor of 212 mW/MHz when combined with the measured capacitance of 110 pF. Dissert. Abstr.

N76-29001 California Univ., Los Angeles.
DISPLACEMENT MEASUREMENTS IN THE INTERIOR OF THREE-DIMENSIONAL BODIES USING SCATTERED LIGHT SPECKLE PATTERNS Ph.D. Thesis
Donald Burwell Barker 1976 105 p
Avail: Univ. Microfilms Order No. 76-15934

Techniques making use of the scattered light speckle patterns were developed which yield the in-plane displacements on an arbitrary interior plane of a three-dimensional body. The technique of Scattered Light Speckle Photography uses a single illuminating beam and is sensitive to displacements greater than one speckle diameter, approximately 3 micrometers. Scattered Light Speckle Interferometry uses two illuminating beams and is sensitive to displacements greater than one-half the wave-length of light being used, approximately 0.2 micrometers. With both techniques, the double exposed speckle photograph is optically processed to yield displacement information. The techniques are demonstrated and the experimental results are compared to known solutions for the problem of a cantilever beam and a point load acting on a half space. A three-dimensional fracture problem of determining the stress-intensity factor variation along the crack front in an ASTM compact-tension specimen is also solved. Dissert. Abstr.

N76-29002*# Itek Corp., Lexington, Mass.
OPTICAL SYSTEMS STUDY FOR ADVANCED FACSIMILE CAMERA
W. J. Davis, P. J. Jarmuz, and C. D. Hardesty [1976] 53 p refs
(Contract NAS1-14195)
(NASA-CR-145031; Itek-76-8271-1) Avail: NTIS HC $4.50 CSCL 20F

Slight modifications on the design of the camera lens and other optical components of the Viking Lander Camera are considered. Topics discussed are: (1) alternative techniques for extending the spectral range of the camera lens (by using fiber optics, mirrors, and infrared detectors), and the development of a wide angle lens, (2) the engineering feasibility of adding one or more infrared detectors sensitive in the 1 micrometer to 2.7 micrometer range, (3) tradeoffs and cost considerations for the modifications of the Viking optical components, lens, etc., and (4) the image quality of the modified lens and other optical components. It was concluded, based on the preliminary design of the wide angle lens, that it will give good performance over a wide field and long spectral range. Tabulated data on the optical properties of the modified lens are given. Engineering drawings are shown. J.R.T.

N76-29003*# Joint Publications Research Service, Arlington, Va.
SPACE LENSES
P. V. Bliokh Washington NASA Jul. 1976 49 p Transl. into ENGLISH from Novoye v Zhizni, Nauke, Tekhn., Ser. Fiz. (USSR), no. 1, 1975 p 1-64
(NASA Order W-13183)
(NASA-TT-F-17083) Avail: NTIS HC $4.00 CSCL 20F

Unusual telescopes are discussed, whereby entire celestial bodies (the moon, sun, and earth) are used as parts of them. The operation of such 'space lenses' is described, and the astronomical investigations in the radio and X-ray bands carried out with them are explained. Part of the discussion is devoted to the lenslife effect of the gravitational fields of the sun and stars. Author

N76-29004# Royal Aircraft Establishment, Farnborough (England).
A REVIEW OF THE MOST IMPORTANT ESTABLISHED FACTS ABOUT THE VISIBILITY (MAXIMUM DETECTION RANGE) OF AIRCRAFT
H. E. Hoffmann Apr. 1976 25 p refs Transl. into ENGLISH from German report DLR-Mitt-74-33, 1974
(RAE-Lib-Trans-1895; BR53107; DLR-Mitt-74-33) Avail: NTIS HC $3.50 CSCL 20F

An aircraft becomes visible for an observer as soon as the differences of brightness between the aircraft and its background are large enough to reach or to exceed the contrast threshold of the human eye. The results of laboratory tests have shown how dependent the contrast threshold is on size and shape of an object, adaptation brightness, exposure time and location of an image on the retina. In field experiments, it was determined in what manner the maximum detection range depends on horizontal standard visibility, type of aircraft, background, adaptation brightness, and on the observer himself. The maximum detection range is the distance in which an aircraft can just be seen. Author

N76-29005# National Inst. for Occupational Safety and Health, Morgantown, W.Va. Testing and Certification Lab.
INDUSTRIAL SOUND LEVEL METER SLOW DYNAMIC CHARACTERISTIC TEST
Alwin Dieffenbach Dec. 1975 19 p refs
(PB-250816/6; NIOSH/TC/P-004) Avail: NTIS HC $3.50 CSCL 14B

A test procedure was devised to determine whether the response of an industrial sound level meter to pulse and steady electrical signals meets specifications known as slow dynamic characteristics. A list of the equipment necessary to perform the test, the configuration in which the equipment is to be used, and a sequenced step by step procedure for performing the evaluation are included. GRA

N76-29006# National Inst. for Occupational Safety and Health, Morgantown, W.Va. Testing and Certification Lab.
INDUSTRIAL SOUND LEVEL METER BATTERY INDICATOR TEST
Robert J. Koshut Nov. 1975 21 p refs
(PB-250815/8; NIOSH/TC/P-003) Avail: NTIS HC $3.50 CSCL 14B

A test procedure to check the battery indicator of a battery operated industrial sound level meter is described. The procedure checks whether battery voltage is adequate to maintain the sound level meter's specified performance when the indicator shows minimally adequate battery voltage. A list of the equipment used and the configuration in which the equipment is to be used are included. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-29007 Vanderbilt Univ., Nashville, Tenn.
THE DYNAMICS AND ENERGETICS OF A HELIUM PLASMA Ph.D. Thesis
Dan Tsun-chuan Wu 1975 180 p
Avail: Univ. Microfilms Order No. 76-15510

The complete time history of the excited species existing in a medium pressure helium plasma at a discharge repetition rate of from 5 kHz to 60 kHz was studied. A set of coupled nonlinear differential rate equations was written appropriate to the kinetic set-up. The Runge-Kutta Gill Solution (RKGS) was used to solve the coupled equations. The Fourier Amplitude Sensitivity Test (FAST) was employed to study the relative importance of the specific fundamental processes among the 19 kinetic processes considered for each excited species (six species appear in the helium system). Through these means the kinetics of the discharge were analyzed and the parameters of the mechanism determined. Time resolved spectroscopy was employed to study the time dependence of the discharge at various wavelengths. It was found that the experimental results are consistent with the theoretical predictions. The kinetics of the 600 A bands of helium were also examined. Dissert. Abstr.

N76-29008 California Univ., Berkeley.
PARAMETRIC INSTABILITIES IN INHOMOGENEOUS PLASMA Ph.D. Thesis
Dwight Roy Nicholson 1975 115 p
Avail: Univ. Microfilms Order No. 76-15322

The nonlinear coupling of three waves in a plasma is considered. One of the waves is assumed large and constant; its amplitude is the parameter of the parametric instability. The spatial temporal evolution of the other two waves is treated theoretically, in one dimension, by analytic methods and by direct numerical integration of the basic equations. Various monotonic forms of homogeneity were considered; agreement with previous work was found and new results were established. Nonmonotonic inhomogeneities are considered, in the form of turbulence, and as a model problem, in the form of a simple sinusoidal modulation. Relatively small amounts of nonmonotonic inhomogeneity, in the presence of a linear density gradient, were found to destabilize the well known convective saturation, absolute growth occurring instead. Dissert. Abstr.

N76-29009 Minnesota Univ., Minneapolis.
INVESTIGATION OF THE ANODE BOUNDARY LAYER OF AN ATMOSPHERIC PRESSURE ARGON ARC Ph.D. Thesis
Joachim Viktor Rudolf Heberlein 1975 152 p
Avail: Univ. Microfilms Order No. 76-14986

The anode boundary layer of an electric high intensity argon arc at atmospheric pressure was investigated spectroscopically. A plane water-cooled copper anode was located 2.3 mm above and perpendicular to the axis of a water-cooled cascaded constrictor. The lateral intensity distributions of several lines and continuum intensities at several different wavelengths were recorded and converted to radial distributions of line and continuum emission coefficients, respectively. Two different nonequilibrium data reduction techniques were employed to obtain values for the interesting plasma parameters, electron and heavy particle temperatures and densities. One of these techniques is based mainly on the approximation of the excited level populations by a Boltzmann-distribution. The other technique is based on additional determination of the electric quantities of the plasma - local electric field strength, electric conductivity and current density - using local values for the collision cross-sections. Agreement of the results obtained with the two methods is very good with respect to electron density and temperature, and is satisfactory for atom density and temperature.
Dissert. Abstr.

N76-29010 Cornell Univ., Ithaca, N.Y.
RELATIVISTIC FLUID EQUATIONS WITH APPLICATIONS TO THE STUDY OF INSTABILITIES IN MAGNETIZED BEAM-PLASMA SYSTEMS Ph.D. Thesis
Gerson Otto Ludwig 1976 225 p
Avail: Univ. Microfilms Order No. 76-15897

Derivation and application are considered of macroscopic equations which describe the behavior of multicomponent relativistic plasmas. The important points can be summarized as follows: (1) derivation of the fully relativistic fluid equations for a Maxwellian plasma and for a strongly magnetized plasma; (2) canonical formulation of the relativistic fluid equations in Eulerian and Lagrangian coordinates; (3) application of the fluid equations to the study of the two-stream instability in homogeneous plasmas, with the inclusion of relativistic and thermal effects; and (4) investigation of the stability of a beam of finite cross-section. Emphasis is given to a class of incompressible surface modes which are not completely stabilized by the external magnetic field. Dissert. Abstr.

N76-29011 Georgia Inst. of Tech., Atlanta.
TRANSPORT PROPERTIES OF LITHIUM AND SODIUM IONS IN GASES Ph.D. Thesis
Garth Russell Akridge 1975 176 p
Avail: Univ. Microfilms Order No. 76-16555

The drift velocities, mobilities, and longitudinal diffusion coefficients of mass-identified Li + ions in He, Ne, and Ar, and of Na+ ions in He, Ne, Ar, and CO2 were measured as a function of E/N, where E is the electric field intensity, and N is the number density of the neutral gas. Deviations from purely Fickian diffusion were examined over a limited range of high E/N. All measurements were carried out at gas temperatures of approximately 300 K and at gas pressures ranging from 0.00246 Torr to 0.493 Torr. Dissert. Abstr.

N76-29012 California Univ., Berkeley.
THE PROPAGATION OF IONIZING WAVES OF POTENTIAL GRADIENT IN PRE-IONIZED CHANNELS Ph.D. Thesis
Andre Lanzaro 1975 117 p
Avail: Univ. Microfilms Order No. 76-15272

Various measurement techniques were used to study the properties of ionizing waves of potential gradient (IWPG) and streamers which result from the application of high altitude impulse potentials to the afterglow channel of a point to plane spark. Time in the afterglow was a parameter used to organize the observed properties. The decay of the free electron density in the afterglow was determined. Impulse potentials varied from 1 kV to 20 kV. Afterglow time range from 30 usec. to 20 msec. after the arc phase of the breakdown spark. A pressure of 250 torr was maintained throughout. Gap lengths varied from 4 to 4.5 cm. For impulse potentials less than 3 kV applied in the early afterglow non-ionizing wave fronts were observed and called Waves of Potential Gradient, WPG. From 4 kV to 8 kV, IWPG were seen. Above 9 kV anomalous IWPG, AIWPG, were observed. A rudimentary theory is discussed to explain the observations. Dissert. Abstr.

N76-29013 California Univ., Davis.
MODE COUPLING OF ELECTRON PLASMA WAVES Ph.D. Thesis
Judith Alice Harte 1975 120 p
Avail: Univ. Microfilms Order No. 76-14211

The driven coupled mode equations are derived for a two fluid, unequal temperature plasma in the one-dimensional, electrostatic model and applied to the coupling of electron plasma waves. Ignoring the nonlinear terms, the equations describe parametric instabilities which are of interest to laser plasma fusion studies. The instability analysis is extended to allow a finite wavelength pump field. When a finite wave number electron plasma wave acts as the pump a reduction of the threshold pump power necessary for onset of the instability can occur. The dispersion of electron plasma waves allows the resonance conditions to be met. In addition a one dimensional electrostatic plasma simulation code was used to study the nonlinearities of the coupled mode equations. The results of the simulations of finite amplitude electron plasma waves demonstrate the dominance of the two step, non resonant direct driving mechanism.
Dissert. Abstr.

N76-29014 California Univ., Berkeley.
THEORETICAL STUDIES OF SOME NONLINEAR LASER-PLASMA INTERACTIONS Ph.D. Thesis
Bruce Ira Cohen 1975 213 p
Avail: Univ. Microfilms Order No. 76-15144

An introduction to three-wave interactions is first presented. Raman scattering is then investigated as a possible plasma heating scheme. Analytic theory complemented by computer simulation is presented describing the nonlinear mode coupling of laser light with small and large amplitude, resonantly excited electron plasma waves. Trapping of electrons in the electron plasma wave is found to be an important nonlinear feature. The nonlinear, time-dependent response for a resonantly excited longitudinal wave is analyzed. Trapping influences the nonlinear dispersion relation of the plasma wave, which plays a significant role in the transfer of energy from the transverse waves to the plasma. The stimulated scattering of a coherent electromagnetic wave by low frequency density perturbations in homogeneous plasma is discussed. A composite picture of the linear dispersion relations for filamentation and Brillouin scattering is constructed. Finally the absolute instability of Brillouin weak and strong coupling is described. Dissert. Abstr.

N76-29015 Texas Univ., Austin.
OBSERVATIONS OF RADIO FREQUENCY GENERATED WAVES IN A BARIUM Q-PLASMA NEAR THE LOWER HYBRID RESONANCE Ph.D. Thesis
Larry Edward Coble 1975 162 p
Avail: Univ. Microfilms Order No. 76-14426

A Q-machine and associated equipment was designed and

constructed such that radio frequency waves having frequencies near the lower hybrid resonance could be inductively and electrostatically coupled into the barium Q-plasma where the characteristics of these waves could be monitored in the radial direction in the plasma. The minimum amplitude of the waves in the center part of the plasma matched within 10% the predicted evanescent region. Investigations were carried out for densities below 6.3 x 10 to the 10th power ions/cu cm, magnetic fields of 2 and 3 KG and loop currents up to 10 amps sub (p-p). The radial and theta electric field components were calculated from measured quantities as a function of the plasma radius. Electron temperatures were found to be near the ionizing plate temperature and unaffected by the RF excitation while the ion temperature increased by about a factor of four when 10 amps sub (p-p) was applied to the single turn loop. Nonlinear interactions of an inductive coupled wave and an electrostatic coupled wave were also observed. Dissert. Abstr.

N76-29016 Texas Univ., Austin.
WAVE PROPAGATION AND RF ASSISTED CONFINEMENT IN A MULTIPLE MIRROR AT THE HARMONICS OF THE ION CYCLOTRON FREQUENCY Ph.D. Thesis
Chandra Mohan Singh 1975 106 p
Avail: Univ. Microfilms Order No. 76-14518

An experimental investigation is presented of the wave propagation characteristics and the RF supplemented confinement enhancement principles of a multiple mirror plasma at the fundamental and second harmonic of the ion cyclotron frequency. Keeping the magnetic field constant, RF power at 5.6 and 11.2 MHz was coupled to a fully ionized plasma with densities of 10 to the 13th power/cu cm. Electrostatically shielded and unshielded single turn circular loop antennas concentric with the plasma column were used to couple RF energy to the plasma such that ci at the point of excitation. Experiments were also done using multiple antennas; up to a maximum of three single turn loop antennas were excited in parallel and in phase from the same RF generator. The wave propagating in the plasma was found to be the fast wave. Measurements of perpendicular and parallel wavenumbers yielded the direction of propagation of the wave such that 47 less than 90 deg. The radial and azimuthal mode structure was found to be discrete.
Dissert. Abstr.

N76-29017 California Univ., Berkeley.
SPECTROSCOPIC STUDY OF ELECTRON ENERGY AND KINETICS OF STATES OF PRINCIPAL QUANTUM NUMBER 2 IN HELIUM PLASMA JETS Ph.D. Thesis
Chi Ching Poon 1975 186 p
Avail: Univ. Microfilms Order No. 76-15345

Number densities of the four n=2 states of helium were determined by absorption in the decaying plasma of radio frequency induction heated free jets and supersonic jets (nominal Mach number of 2). Coupled with the electron temperature and density of the plasma, obtained from spectroscopic measurements of absolute intensities of plasma emission, the principal kinetic processes between the four n=2 states were identified. From the rate balance of n=2 atomic states, de-excitation by superelastic collisions appeared to cascade to the nearest n=2 state of lower ionization energy. The rate coefficients at 0.12 eV were obtained from Mach 2 jet measurements. The electron energy balance was studied in detail. Results confirmed that, the principal cooling mechanism was elastic collisions between ions and electrons and the principal heating mechanism was the de-excitation of He(2sub 3 S) by inelastic collisions with electrons and by binary collisions among themselves. An experimental recombination rate was also obtained from the summation of optical transitions. Dissert. Abstr.

N76-29018*# North Carolina State Univ., Raleigh.
THE ELECTRON BOLTZMANN EQUATION IN A PLASMA GENERATED BY FISSION FRAGMENTS
H. A. Hassan and Jerry E. Deese Washington NASA Jul. 1976 31 p refs
(Grant NsG-1058)
(NASA-CR-2712) Avail: NTIS HC $4.00 CSCL 20I

A Boltzmann equation formulation is presented for the determination of the electron distribution function in a plasma generated by fission fragments. The formulation takes into consideration ambipolar diffusion, elastic and inelastic collisions, recombination and ionization, and allows for the fact that the primary electrons are not monoenergetic. Calculations for He in a tube coated with fissionable material show that, over a wide pressure and neutron flux range, the distribution function is non-Maxwellian, but the electrons are essentially thermal. Moreover, about a third of the energy of the primary electrons is transferred into the inelastic levels of He. This fraction of energy transfer is almost independent of pressure and neutron flux but increases sharply in the presence of a sustainer electric field. Author

N76-29019# California Univ., Livermore. Lawrence Livermore Lab.
ARGUS TARGET CHAMBER
F. Rienecker, Jr., S. S. Glaros, and M. Kobierecki (E. G. and G., Inc.) 12 Nov. 1975 7 p Presented at the 6th IEEE Symp. on Eng. Problems of Fusion Research, San Diego, Calif., 18-21 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77248; Conf-751125-12) Avail: NTIS HC $4.50

A target chamber for application in the laser fusion program must satisfy some very basic requirements: (1) provide a vacuum on the order of 0.000001 torr; (2) support a microscopically small target in a fixed point in space and verify its location within 5 micrometers: (3) contain an adjustable beam focusing system capable of delivering a number of laser beams onto the target simultaneously, both in time and space; (4) provide access for diagnostics to evaluate the results of target irradiation; (5) have flexibility to allow changes in targets, focusing optics and number of beams. The ARGUS meets these requirements in a simple economic manner. The chamber and auxiliary equipment are described, with reference to two double beam focusing systems; namely, lenses and ellipsoidal mirrors. Author (ERA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N76-29020 Minnesota Univ., Minneapolis.
CRYSTAL SHAPE DEPENDENCE OF INTRAMOLECULAR VIBRATIONAL EXCITON STATES IN MOLECULAR CRYSTALS Ph.D. Thesis
Theodore Wilczek, Jr. 1975 197 p
Avail: Univ. Microfilms Order No. 76-14875

By the use of the Lorentz sphere-plus-polarized continuum approach suggested by Fox and Hexter in the transition-dipole-transition-dipole interaction model approximation, the quantitative effects of external crystal shapes and their orientation with respect to the crystallographic axes on the magnitudes of the Davydov splittings and relative intensities of the components of a multiplet which result from the coupling of gas phase infrared active vibrational modes in isotopically pure crystallites of complicated molecular crystals (cyanogen, benzene, methyl chloride and ammonia) have been analyzed. To evaluate the lattice sums of point dipole-dipole interactions, the rapidly converging DeWette-Schacher planewise summation method has been used. The necessary depolarization corrections were later made to these initial slab shaped summation results. Dissert. Abstr.

N76-29021 California Univ., Berkeley.
ELECTRON PARAMAGNETIC RESONANCE STUDIES OF THE RELAXATION OF COPPER (2), TITANIUM (3), VANADYL IONS IN SOLUTION Ph.D. Thesis
Richard Craig Wilson 1975 114 p
Avail: Univ. Microfilms Order No. 76-15448

The EPR spectra of solutions of vanadyl acetylacetonate in liquid ammonia, at X-band (9 GHz), were determined as a function of temperature. The spectrum in a frozen glass composed of equal parts ammonia and tetrahydrofuran was found to follow an axial spin Hamiltonian. The temperature dependence of the linewidths in liquid ammonia was found to be consistent with relaxation caused by spin-rotation interaction, and tumbling of an anisotropic spin Hamiltonian. The hydrodynamic radius for

both processes was 3.53A. Unresolved N superhyperfine interaction resulted in a broadening of about 1 gauss.
Dissert. Abstr.

N76-29022 Brown Univ., Providence, R.I.
CORE TRANSITIONS IN SEMICONDUCTORS Ph.D. Thesis
John Sherman DeWitt 1975 235 p
Avail: Univ. Microfilms Order No. 76-15623

A theoretical study is reported of photoabsorption processes involving d-state core transitions in four semiconductors: Ge, GaAs, alpha Sn, and InSb. The absorption coefficient is derived for these transitions from a density of states calculation together with k-dependent transition matrix elements. A mixed basis set is used. The valence states are a full zone kxp expansion of gamma point basis states derived from a pseudopotential. The crystal core states are a tight binding expansion of Hartree-Fock-Slater core orbitals. Spin orbit splitting of both the core and valence states is included. Matrix elements are calculated between all core levels and the lowest lying conduction states. The density of conduction states is calculated for the lowest 14 conduction bands and combined with matrix elements between these bands and the highest lying core d-band to derive the absorption coefficient. Dissert. Abstr.

N76-29023 California Univ., Berkeley.
THE ELECTRONIC STRUCTURE OF MOLECULES, SOLIDS, AND SOLID SURFACES Ph.D. Thesis
James Robert Chelikowsky 1975 312 p
Avail: Univ. Microfilms Order No. 76-15443

A detailed study is undertaken to investigate the electronic structure of eleven diamond and zincblende semiconductors: Si, Ge, GaAs, ZnSe, alpha-Sn, InSb, CdTe, GaP, GaSb, InP and InAs. By means of an empirical non-local pseudopotential scheme the optical spectrum, electronic density of states, and valence charge density is calculated for each compound. The theoretically required parameters are determined by comparisons with optical and photoemission experimental measurements. In particular, the effect of a non-local potential on the electronic structure of each compound is investigated. It is found that the local pseudopotential approach can yield incorrect band topologies, optical gaps, charge densities and valence band widths. All of these defects can be corrected by the addition of a non-local term to the pseudopotential. In addition, to the calculations performed on these bulk materials, a method for calculating the electronic structure of non periodic systems is developed.
Dissert. Abst.

N76-29024 Brown Univ., Providence, R.I.
OPTIC VIBRATIONS IN AMORPHOUS AND CRYSTALLINE As2S3 AND As2Se3 Ph.D. Thesis
Alfred Peter DeFonzo 1975 208 p
Avail: Univ. Microfilms Order No. 76-15622

High temperature < 1000 K Raman scattering techniques are described. Results of temperature dependent polarized Raman scattering intensity measurements on molten As2S3 and As2Se3 are reported and a new approach to the vibrational problem of complex semiconductors is presented. Calculations and the assignment of the high frequency optic vibrational eigenfrequencies and eigenvectors are given for the crystal, glass and liquid states of As2S3 and As2Se3 revealing the fundamental differences of each spectra. A model for the atomic correlations in liquid and glass states is proposed. The semiclassical linear polarizability theory of first order Raman scattering is extended and applied to account for these correlations. Dissert. Abstr.

N76-29025 Minnesota Univ., Minneapolis.
HOT ELECTRON EFFECTS IN MOSFET'S Ph.D. Thesis
Nick Gust Constantine 1975 116 p
Avail: Univ. Microfilms Order No. 76-14877

Expressions for the mobility that are consistent with recent experimental and theoretical evidence have been established and the I-V characteristic, the transconductance and noise in MOSFET's have been evaluated. The results show a decrease in the normalized saturation current as the gate voltage is increased, sharp onset of saturation, a decrease of the normalized saturation value of the drain voltage at which saturation occurs as the gate voltage is increased, and a saturation of the saturated transconductance of the device at high fields. These results are in agreement with recent experimental results. In evaluating the noise of the device it was found that the increase in the noise resistance of MOSFET's results from the drastic change in the transconductance due to the field dependence of the mobility and not as a result of an increase in electron temperature as was previously thought. Dissert. Abstr.

N76-29026 Cornell Univ., New York.
VIBRATIONAL ENERGY EXCHANGE AND DEACTIVATION PROCESSES IN THE HF-DF, HF-CO2 AND DF-CO2 SYSTEMS FROM 205K TO 675K Ph.D. Thesis
Roy Alan Lucht 1976 126 p
Avail: Univ. Microfilms Order No. 76-15896

A laser induced fluorescence technique was used with a repetitively pulsed HF or DF chemical laser excitation source in order to study vibrational energy transfer. Fluorescence from the vibrationally excited states of HF, DF, and CO2 was directed to an InSb detector through appropriate thin film interference filters and temporally resolved. Self relaxation rates were observed to have nonlinear pressure dependencies below temperatures of 225 K. This effect is attributed to fast deactivation by HF or DF polymers. Rates and the corresponding probabilities at temperatures from 225 K to 500 K are shown to exhibit strong inverse temperature dependencies. The present data, in conjunction with previously reported high temperature shock tube results, define the temperatures of the probability minima of several kinetic processes. The temperature dependent probability curves are discussed in relation to energy transfer theory. Although no single consistent theory explains all the observed phenomena, several axioms necessary to any successful theory are introduced. Dissert. Abstr.

N76-29027 Oregon Univ., Eugene.
ORBITAL MAGNETIC SUSCEPTIBILITY IN THE HIGH TEMPERATURE, LOW-FIELD LIMIT FOR A SYSTEM OF ELECTRONS MOVING IN AN ARBITRARY POTENTIAL Ph.D. Thesis
Donald Bertrand Bivin 1975 128 p
Avail: Univ. Microfilms Order No. 76-15027

A general expression for the zero field limit orbital magnetic susceptibility of a Maxwell-Boltzmann gas of charged, spinless particles is developed. Then this expression is simplified for the case when the operators in the trace which compose the expression for the susceptibility may be cyclically permuted. The existence of size and shape corrections to the high temperature limit of the susceptibility is examined by confining the particles in some region by a potential which increases without bound as configuration space variables become infinite. The two leading terms in the expansion of the susceptibility in a power series in inverse temperature are derived and it is shown that the high temperature limit of the susceptibility is given by the so called Landau value of x = -1/3-(eh/mc)square 1/KT with corrections due to the potential appearing only to higher order in inverse temperature. Dissert. Abstr.

N76-29028 Brown Univ., Providence, R.I.
SOME ASPECTS OF NON-LINEAR ABSORPTION IN ZINCBLENDE SEMICONDUCTORS Ph.D. Thesis
Stephen J. Bepko 1975 154 p
Avail: Univ. Microfilms Order No. 76-15610

A consistent theory based on Maxwell's Equations in nonlinear is presented for both second harmonic generation and subsequent absorption and two photon absorption in the context of non linear optics. An expression for the part of the third order susceptibility tensor governing two photon absorption is derived in detail, and the precise equivalence of this formulation with the more common second order golden rule approach is shown. It is shown that both second harmonic and two photon absorption effects are not isotropic in zincblende semiconductors but depend on the polarization of the incident light and the directions of the crystal axes. Expressions are derived for the non linear absorption coefficient for both polarized and unpolarized light for various directions of normal incidence. Dissert. Abstr.

N76-29029 Brown Univ., Providence, R.I.
OPTICAL PROPERTIES AND LATTICE VIBRATIONS OF THE (CuInSe2) SUP 1-x-(2ZnSe)SUP x Ph.D. Thesis

Jimy Ng Gan 1975 131 p
Avail: Univ. Microfilms Order No. 76-15637

An interesting new group of materials which are extensions of the elemental and binary tetrahedrally-bonded semiconductors are the ternary materials of the form II-IV-V sub 2 and I-III-VI sub 2. The basic structural element is still the tetrahedron. However, the crystalline structure is chalcopyrite. This differs from the zinc blende structure of the binary compounds by a slight distortion along one (100) axis, by having two cations instead of one and by having a larger unit cell. Interesting changes in physical properties occur as a result of these structural differences. Information about the electronic states was obtained from the real and imaginary part of the dielectric function determined from the measurement of transmission and reflection spectra in the range of 0.5 to 14 eV. Lattice vibrations were studied by infrared reflectivity and Raman scattering experiments in the range 50 to 500 per cm. Dissert. Abstr.

N76-29030 Rochester Univ., N.Y.
EXPERIMENTAL INVESTIGATIONS OF HIGHLY CONDUCTING QUASI ONE-DIMENSIONAL ORGANIC CHARGE TRANSFER SALTS Ph.D. Thesis
David Earl Schafer 1976 169 p
Avail: Univ. Microfilms Order No. 76-14783

Experimental investigations discussed involving measurement of electrical conductivity, thermoelectric power, thermal expansivity, spin resonance and magnetic susceptibility, were aimed at characterizing the nature of the quasi one-dimensional electrical transport in TTF-TCNQ and other highly conducting organic charge transfer salts. One particular goal was a clarification of the possible roles of single-particle processes vs. one-dimensional collective effects in the metallic temperature dependence of the conductivity of TTF-TCNQ above 60 K, and in the metal-semiconductor transition at 53 K. Electrical measurements on single-crystal TTF-TCNQ samples indicated a large and strongly temperature-dependent conductivity anisotropy. The possible effects of the large anisotropy on conventional four-probe conductivity measurements were also investigated, and it was found that spurious enhancement of the apparent conductivity by at least a factor of ten could be produced by either misalignment of small contacts or by subtler contact inhomogeneities. A simple experimental check for such enhancement is proposed.
Dissert. Abstr.

N76-29031 Illinois Univ., Urbana.
THERMAL CONDUCTIVITY OF SUPERCONDUCTING ALLOY FILMS IN A PERPENDICULAR MAGNETIC FIELD Ph.D. Thesis
Jeffrey Owen Willis 1976 126 p
Avail: Univ. Microfilms Order No. 76-16213

The thermal conductivity of superconducting films of In - Bi alloys in a perpendicular magnetic field is measured. The films were quench-condensed onto glass substrates held at 77K and had thicknesses ranging from 1050 to 4570 A. The thermal conductivity was plotted as a function of magnetic field. The resulting curve, except for some rounding very close to H sub c2, was found to be approximately linear for magnetic fields greater than 60 percent of H sub c2. This linear behavior is in qualitative agreement with the theory of Caroli and Cyrot for the electronic thermal conductivity of a dirty superconductor near H sub c2. The magnetization of the In - Bi alloy films, with the help of theoretical calculations based on the critical-field values was inferred. The experimental ratios of the slopes were 10 to 30 percent below the theoretical values. In attempting to explain this discrepancy, it is speculated that k sub 2 varies more rapidly than theory predicts. Dissert. Abstr.

N76-29032 Cornell Univ., Ithaca, N.Y.
EXPERIMENTAL STUDIES OF SUPERCONDUCTING WEAK LINKS Ph.D. Thesis
Lawrence David Jackel 1976 252 p
Avail: Univ. Microfilms Order No. 76-15925

It was shown that there is a great variety of current-phase relations in different types of weak links. Fluxoid transition distributions of superconducting weak-link rings were shown to be strongly correlated with the form of the weak-link current-phase relation: the more nearly sinusoidal the current-phase relation, the narrower the distribution width. I-V measurements made in conjunction with the current-phase studies have shown that most weak-link behavior at low voltages can be explained by an equivalent circuit representation similar to that of McCumber and Stewart, except that the proper model must include the correct weak-link current-phase relation. Measurements were first made on an oxidized niobium point contact; a sinusoidal current-phase relation was found. Measured fluxoid transition distributions were in excellent agreement with the theoretical predictions of Kurkijarvi. The first distinctly non-sinusoidal current-phase relations were found in uniform thickness tin bridges. Dissert. Abstr.

N76-29033 California Univ., Berkeley.
TRANSPORT AND OPTICAL PROPERTIES OF BAND ELECTRONS IN A MAGNETIC FIELD Ph.D. Thesis
William Yang-Hsing Hsu 1975 174 p
Avail: Univ. Microfilms Order No. 76-15227

The electronic structure of a perfect tight-binding crystal under an external magnetic field is investigated. A quantitative analysis based on a method of continued fractions is developed. This method is compatible with the magnetic translation group. Calculations are carried out for various fields, and an interpolation scheme, valid for fields up to 1,000,000 G, is presented. In the two dimensions perpendicular to the magnetic field, the density of electronic states consists of subbands, i.e., broadened levels, separated by gaps. The broadening is negligible for most levels. It is, however, paramount in narrow energy ranges close to two-dimensional saddle-points, where for all practical purposes the subbands merge into a single continuum. The resulting electronic structure is applied to study the magneto-optical response of a hypothetical simple-cubic crystal with infinitely narrow core states. Wavelength and field strength modulations are also discussed. Dissert. Abstr.

N76-29034 California Univ., Berkeley.
THE ELECTRONIC PROPERTIES OF THE TRANSITION-METAL MONOXIDES Ph.D. Thesis
Belita Koiller 1975 92 p
Avail: Univ. Microfilms Order No. 76-15262

Models used to study the conductivity properties of transition-metal oxides are examined. It is found that although the band structure picture explains many cases , it fails to explain the conductivity behavior of transition-metal monoxides. A model which involves itinerant metallic-s-electrons and oxygen-p-electrons, and localized highly correlated transition-metal d-electrons is presented. Such a model explains the good conductivity of TiO, the semiconducting properties of VO and FeO, and the good insulating character of MnO, CoO and NiO. Extensions of the model to explain optical properties are included. Based on this model, a theory is formulated to calculate the exchange constants J sub 1 and J sub 2 for first and second neighbors in the transition-metal monoxides. The calculation involves d-s and d-p hybridization to fourth order in perturbation theory. Calculations for NiO reinforce the validity of the proposed model for the electronic structure. Finally, the effect of atomic vacancies in the electronic structure of VO, and how they can account for its conductivity properties, are discussed.
Dissert. Abstr.

N76-29035 Case Western Reserve Univ., Cleveland, Ohio.
COMPUTER ANALYSIS OF ZERO BIAS SCHOTTKY BARRIER VARICAP DIODES WITH NONUNIFORM IMPURITY PROFILE Ph.D. Thesis
Mustafa G. Guvenc 1976 186 p
Avail: Univ. Microfilms Order No. 76-16046

The effect of impurity concentration profile on the capacitance - voltage characteristics of the diode was detailed. Aluminum-Silicon Schottky barrier structure with impurity concentration distributions having a peak at the metal-semiconductor interface and decreasing into the semiconductor was analyzed. The diode capacitance was calculated quasi-statically from the potential and field distributions in the semiconductor. A Poisson's equation was solved numerically. A computer program developed utilizes a correction scheme to overcome the inherent instabilities encountered in the numerical solution of Poisson's equation and computes the potential and field distributions in the diode structure with better than 7 digit accuracy. The computer simulation of Schottky barrier varicap

diode structures with rectangular, Gaussian and exponential impurity concentration profiles, indicates a possible order of magnitude improvement in zero-bias sensitivity over that of a uniformly doped diode. The simulated diodes show linear tuning characteristics with less than 0.5% distortion in a + 20% frequency range with cut-off frequencies on the order of 1 GHz.
Dissert. Abstr.

N76-29036 City Univ. of New York.
BAND STRUCTURE OF CRYSTALLINE ANTHRACENE AND ITS DEPENDENCE ON PRESSURE Ph.D. Thesis
Salah E. M. Elnahwy 1976 179 p
Avail: Univ. Microfilms Order No. 76-14735

High purity single crystals of anthracene were grown. The linear compressibilities were measured using neutron diffraction techniques on single crystal samples. The values of the linear compressibilities were used to improve the values of the elastic constants available from ultrasonic measurements. A band scheme for an excess hole and an excess electron was introduced. Knowing the linear compressibilities, it was possible to calculate the change of the band structure, the drift and Hall mobilities with pressure. The proposed scheme predicted the anisotropy of the drift mobility to agree quite well with the experimental anisotropy except for electrons in the C'direction. Dissert. Abstr.

N76-29037 Illinois Univ., Urbana.
A FORMALISM FOR MULTIPLE SCATTERING Ph.D. Thesis
Verena Stocker 1976 103 p
Avail: Univ. Microfilms Order No. 76-16200

An exact method for treating multiple collisions is developed. The formalism is valid at all energies and all densities. The multiple scattering formalism is based on the amplitude density function method which was originally derived for solving single collision problems numerically. The formalism yields a relationship between the total transition matrix due to multiple collisions and the transition matrices due to single collisions. Relations are given for multiple scattering to all orders of a molecule from nonoverlapping fixed scattering centers. The application of the formalism to scattering from a rotor and the necessary approximations which lead to the complete decoupling of the scattering equations are discussed. Dissert. Abstr.

N76-29038 California Univ., Berkeley.
SCHOTTKY AND JOSEPHSON DEVICES ON THIN SILICON MEMBRANES Ph.D. Thesis
Chiang-Liang Huang 1975 128 p
Avail: Univ. Microfilms Order No. 76-15228

Thin silicon membranes were used to fabricate Schottky diodes and silicon-barrier Josephson junctions. These membranes are prepared by preferential chemical etching of a silicon wafer. Membrane thicknesses of a few hundred angstroms to several microns can be accurately controlled and transverse dimensions of 0.1 microns to a few centimeters can also be achieved with accuracy. It was shown that these membrane super-Schottky diodes have significantly lower series resistance than the comparable diodes made on conventional silicon wafers. This is desirable for high-frequency detection and mixing applications. In fact, it appears that the same approach can be used to make essentially all types of high-frequency diodes. Crystalline silicon-barrier Josephson junctions were also made in which supercurrents exist for membrane thicknesses of up to 1300 angstroms. The dependence of the junction characteristics on barrier thickness and doping profile was experimentally measured and theoretically discussed. Dissert. Abstr.

N76-29039 California Univ., Berkeley.
STUDY OF PbTe SCHOTTKY BARRIER DIODES Ph.D. Thesis
Hsing-Hsien Kung 1975 159 p
Avail: Univ. Microfilms Order No. 76-15266

The properties and fabrication technology of PbTe Schottky barrier diodes were investigated. Diodes were fabricated using various surface preparation substrate temperatures during evaporation, metals (Pb, Sn, Au and Al), and bulk concentrations. From these results, a reproducible fabrication procedure was developed. In addition, the annealing of completed diodes in the temperature range 70 C to 150 C was studied. The current voltage characteristics of these diodes were also investigated from liquid helium temperature to room temperature. Based on a potential barrier model and a nonparabolic dispersion relation, the tunneling probability can be calculated by WKB approximation. The total current density can then be calculated numerically from the basic tunneling equation. A number of approximations were made which allow the development of an analytical model for the I-V characteristics. Dissert. Abstr.

N76-29040 Cornell Univ., Ithaca, N.Y.
EXPERIMENTAL AND THEORETICAL STUDIES OF ION-IMPLANTED SILICON READ IMPATT DIODE Ph.D. Thesis
Yee Chuk Richard Kwor 1976 144 p
Avail: Univ. Microfilms Order No. 76-15889

The properties of an X-band Silicon Read IMPATT diode were studied both experimentally and theoretically. Diodes with a structure of p(+) n nu n(+) were fabricated using ion-implantation techniques. Phosphorus was implanted into the nu on n(+) epitaxial wafers as the n-region dopant. Boron was then implanted as the p(+) contact. The implanted wafer was annealed at 950 C for half an hour. Diodes were fabricated and were subjected to various microwave tests, including noise, reflection amplifier and oscillator measurements. As an oscillator, the implanted diode showed an efficiency of 8.4 percent at 200 A/sq cm bias current density. It was found that, as a result of high reverse saturation current, the phase lag angle between the avalanche particle current and the external field excitation is less than the ideal value of 90 percent. This was the principal cause for the lower-than-expected efficiency.
Dissert. Abstr.

N76-29041 California Univ., Berkeley.
RADIATION INDUCED FAILURE MECHANISMS IN MOSFETS Ph.D. Thesis
Eng Tsan Gaw 1975 291 p
Avail: Univ. Microfilms Order No. 76-15189

A theoretical framework for explaining radiation induced changes in MOS device properties is derived. Trap-free theoretical threshold voltage as obtained by the depletion approximation is compared to the more accurate value as obtained by the linear extrapolation method, over a broad range of temperature. Effects of surface states on theoretical threshold voltage are considered. An approximate expression is derived for the theoretical threshold voltage as a function of source to substrate reverse voltage (body bias effect), for nonnegligible surface state density. Effects of bulk traps on theoretical threshold voltage are also considered. Truncated trap space charge approximation is used in the derivation of an approximate expression for the theoretical threshold voltage, including body bias effect. Dissert. Abstr.

N76-29042 Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF THE ACTION OF ADDITIVES AND OF WALL-LIQUID CRYSTAL INTERFACE Final Report [ETUDE DE L'ACTION DES ADDITIFS ET DE L'INTERFACE PAROI-CRISTAL LIQUIDE]
Jean Claude Dubois, Maryse Gazard, Annie Zann, Michel Hareng, and Jean Jacques Metzger 15 Dec. 1974 60 p refs In FRENCH
(Contract DGRST-73-7-1379)
(LCR-74-250/R/G.5) Avail: Issuing Activity

Two methods for orientation control of liquid crystal molecules on a wall are considered with a view to improving liquid crystal displays. The homeotropic orientation with molecules perpendicular to the wall was studied using either a surfactant in the liquid crystal or the polymerization of an organic film on the wall. For homogeneous orientation parallel to a direction on the wall the best results were obtained by SiO evaporation under oblique incidence. In all cases the characterization of the interfaces was performed using a polarizing microscope, measurement of the cell capacitance, observation of structural crystal defects, and measurement of the voltage thresholds corresponding to the Freedericksz transitions. The various procedures and operating conditions are detailed together with an analysis of their consequences on the various crystal-wall interface characteristics. ESA

N76-29043 Commissariat a l'Energie Atomique, Grenoble (France). Lab. de Microelectronique.
CALCULATION OF IMPURITY PROFILES AND DEPOSITED ENERGY IN MONO AND DIATOMIC SUBSTRATES. COMPARISON WITH EXPERIMENTS Final Report [CALCUL DE PROFILS D'IMPURETES ET D'ENERGIE DEPOSEE DANS DES SUBSTRATS MONO ET DIATOMIQUES. COMPARAISON AVEC L'EXPERIENCE]
J. L. Combasson Nov. 1974 117 p refs In FRENCH
(Contract DGRST-73-7-1390)
Avail: Issuing Activity

A computer program based on the Winterbon series is described. It is used to calculate impurity profiles or deposited energy for implanted ions outside a channel. Comparisons with other existing programs are presented. It is shown that calculated dissymmetries, especially in the case of boron in silica are real and were actually observed. Some possible applications are reviewed. ESA

N76-29044*# Kanner (Leo) Associates, Redwood City, Calif.
VALIDITY OF CERTAIN SIMPLE ELECTRON MODELS OF CARBONS
F. Boy and A. Marchand Washington NASA Aug. 1976 24 p refs Transl. into ENGLISH from Carbon (England), v. 5, no. 3, Jun. 1967 p 227-241 Sponsored by NASA
(NASA-TT-F-17136) Avail: NTIS HC $3.50 CSCL 20L

A number of band models are suggested to explain various electronic properties of pregraphitic carbons. Unfortunately, the validity of each model does not extend beyond the property for which it was designed. The general validity of some of the simpler models was tested as follows: sets of reasonable values were selected for the band parameters of these models; calculations of the theoretical values of para- and dia-magnetic susceptibilities and of the Hall effect were made. The theoretical properties were compared with the results obtained from measurements of various kinds of carbons. The conclusion is that all of these simple models are inadequate, since they fail to account for two different properties of a given carbon. Author

N76-29045# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
COMPUTER PROGRAMS FOR STRUCTURAL CHEMISTRY. MATCH1 AND MATCH2, FORTRAN PROGRAMS TO PREDICT AND EVALUATE MUTUAL ORIENTATION OF POLYCRYSTALS
Brian Dickens and LeRoy W. Schroeder Jan. 1976 161 p
(Grants PHS-DE-40015; PHS-DE-00572)
(PB-250743/2; NBS-TN-893) Avail: NTIS HC $6.75 CSCL 20B

Two computer programs to evaluate possible structural matches for use in epitaxy and twinning studies have been written in FORTRAN 5 for the UNIVAC 1108. They should be readily convertible to other comparable computers. The first program, MATCH1, requires knowledge of the unit cell parameters. It obtains all matching networks in two unit cell lattices and sorts the matches into an order of probable epitaxy (or twinning if the two unit cells are the same) based solely on criteria of dimensional mismatch and network area. The second program, MATCH2, requires knowledge of positional parameters of the atoms in the crystal structures. It calculates the degree of structural fit for slices supplied from visual inspection of the crystal structures or as matching networks determined by MATCH1. The slice comparison is carried out in terms of the vector set of the environment of each atom in each slice. The procedure is not valid when the twin operation is a rotation about the normal of the compositional plane or a reflection in a mirror parallel to this plane. The atomic patterns comprising the slices are matched piece by piece in MATCH2. A third program, MATCH3, will match whole patterns once three fiducial atoms in each pattern have been picked from the output of MATCH2 and will handle all the twinning cases. This Technical Note explains the procedure in MATCH1 and MATCH2 and includes examples of results. GRA

N76-29046# Montana State Univ., Bozeman. Dept. of Physics.
FAR ULTRAVIOLET PHOTOEMISSION STUDIES OF THE ELECTRONIC STRUCTURE OF SOLIDS Final Report, 1 Feb. 1971 - 30 Jun. 1975
Gerald J. Lapeyre Sep. 1975 15 p refs
(Grant AF-AFOSR-2061-71; AF Proj. 9763)
(AD-A020749; AFOSR-76-0021TR) Avail: NTIS CSCL 20/3

Ultraviolet photoemission spectroscopy (PES) was used to study properties of solids over a wide energy range. A new type of PES spectrometer was designed and constructed so spectra at high energy could be obtained with synchrotron radiation from the storage ring at the University of Wisconsin. In the latter part of the program the spectrometer was modified so angle-resolved data was obtained. Quantum phenomena, not normally studied in UPES experiments, were investigated with the aid of two new PES data scans developed in this program. The scans called CIS and CFS frequently make it possible to observe emission properties which are very difficult to extract from the traditional energy distributions curve (EDC) data. The quantum properties determined in this program came from observing core and valence band (VB) excitations. In addition to direct emission for core excitations, the electrons generated by decay of the core holes were measured with CIS and CFS data. GRA

N76-29047# RAND Corp., Santa Monica, Calif.
ADVANCED CONCEPTS OF SUPERCONDUCTIVITY: A COMPARATIVE REVIEW OF SOVIET AND AMERICAN RESEARCH. PART 2: HIGH PRESSURE SUPERCONDUCTIVITY Interim Report
Yuri Ksander and Stanley Singer Jan. 1976 45 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A020981; R-1579-ARPA-Pt-2) Avail: NTIS CSCL 20/3

The second of three reports on superconductivity, this examines laboratory techniques for obtaining high pressures and their effects on the superconducting properties of materials. (The first, R-1401-ARPA, treated high-temperature superconductivity; the third will discuss high-field superconductivity.) An assessment of U.S. and Soviet research in high-pressure superconductivity (HPS) based on a comprehensive coverage of open-source literature from 1971 through June 1974. Megabar pressure capability is at hand, thanks to development of very hard structural materials. Experimental data are copious, although the pressure range is limited and volume parameters are almost lacking. Soviet HPS research appears to be materials-oriented, American more academic. Hydrogen Metallization under superhigh pressure is of major interest in the Soviet new materials program. HPS research has placed the USSR in a position of major strength in this field. Author (GRA)

N76-29048# California Univ., Los Angeles. Dept. of Physics.
SURFACE WAVES IN A CRYSTAL LATTICE Interim Report
L. N. Rosenzweig 1969 21 p refs Transl. into ENGLISH from Fizicheskovo Otdeleniya Fiziko-Mathematicheskovo Fakulteta, Trudy, (USSR), v. 2, 1950 p 19-36
(Contract N00014-69-A-0200-9003; NR Proj. 392-001)
(AD-A021246; TR-75-44) Avail: NTIS CSCL 20/12

In a recently published paper by I. M. Lifshitz and the author, general equations were obtained determining the exact dispersion law and form of surface waves in a crystal, regarded as a discrete structure. In the present paper these equations are subjected to a detailed investigation for several simple models of crystal lattices. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-29049 California Univ., Berkeley.
STATISTICAL THERMODYNAMICS OF HYDROCARBON MIXTURES FOR PROCESS DESIGN Ph.D. Thesis
Enrique Rodolfo Bazua 1975 103 p
Avail: Univ. Microfilms Order No. 76-15105

The goal of this work is to produce a reliable method for estimating phase equilibria and enthalpies as required in the design of units for refining petroleum and natural gas. The first step is to establish a partition function. From this partition function compressibility factors, fugacities, entropies, and enthalpies are calculated. There are three important advantages in using a partition function for calculating thermodynamic properties. These are: (1) one unified, continuous treatment is used for both the liquid and the vapor phase. (2) one unified treatment is used for all residual properties (i.e., those relative to the ideal gas at the same temperature, density, and composition): compressibility factors, entropies, enthalpies, and fugacities, (3) there is no need for standard states, real or hypothetical. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-29050 Texas Univ., Austin.
APPLICATION OF THE PARTITIVE ANALYTICAL FORECASTING(PAF) TECHNIQUE TO THE UNITED STATES CONTROLLED THERMONUCLEAR RESEARCH EFFORT Ph.D. Thesis
Steven Parks Nichols 1975 338 p
Avail: Univ. Microfilms Order No. 76-14500

The Partitive Analytical Forecasting (PAF) technique is applied to the overall long-term program plans for the Division of Controlled Thermonuclear Research (DCTR) of the United States Energy Research and Development Administration (ERDA). As part of the PAF technique, the Graphical Evaluation and Review Technique (GERTS) Z computer code is used to perform simulations on a logic network describing the DCTR long-term program plan. Logic networks describing the Tokamak, mirror, and theta-pinch developments are simulated individually and then together to form an overall DCTR program network. The results of the simulation of the overall network using various funding schemes and strategies are presented. An economic sensitivity analysis is provided for the Tokamak logic networks. An analysis is also performed of the fusion-fission hybrid concept in the context of the present DCTR goals. The results are evaluated, and recommendations for further research are discussed.
Dissert. Abstr.

N76-29051# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
ALASKAN METHANOL CONCEPT, A PRE-FEASIBILITY STUDY
Carl O. Thomas Nov. 1975 235 p refs
(Contract DI-14-01-0001-1699)
(PB-249350/0; IEA(M)-75-5) Avail: NTIS HC $8.00 CSCL 21D

The results are presented of a six month pre-feasibility study on the Alaskan Methanol Concept. At present there are two proposals for an Alaskan natural gas transmission system pending before appropriate governmental agencies. The methanol concept is viewed as a potential alternative in the event that there should be long delays in permitting and constructing one or the other of the two gas lines, thus creating an unacceptable cost for energy receipt delay. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

No abstracts in this category.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-29052*# Scientific Translation Service, Santa Barbara, Calif.
PLANS OF BAYESIAN EXPERIMENTS IN ECONOMIC MEASUREMENT
J. P. Marciano Washington NASA Jul. 1976 35 p refs Transl. into ENGLISH from Rev. Statist. Appl. (France), vol. 19, 1971 p 45-70
(Contract NAS7-100)
(NASA-TT-F-16757) Avail: NTIS HC $4.00 CSCL 05C

The application of random effect Bayesian trial design to econometrics is discussed. A complete methodology is described which, for a design in two or more dimensions, allows calculation of revised expectations and intra-treatment variances for different treatments, even though there is only one of them in the fixed effect model. In addition, the calculation of an inter-treatment variance in such a model is considered. Author

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-29053# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1977, PART 2
Washington GPO 1976 639 p refs Hearings on S. 2864 before Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 26, 27 Jan. and 3 Feb. 1976
(GPO-67-625) Avail: Comm. on Aeron. and Space Sci.

A bill to authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management, etc. is proposed. Further development of the space shuttle, fuel-efficient aircraft, and technology transfer are among the topics discussed. For vol. 1, see N76-20025. J.M.S.

N76-29054# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1977, PART 3
Washington GPO 1976 656 p refs Hearings on S. 2864 before Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 17, 24 Feb. and 3 Mar 1976
(GPO-68-258) Avail: Comm. on Aeron. and Space Sci.

Appropriations to the National Aeronautics and Space Administration are discussed. Development of aircraft engines which reduce fuel consumption, jet aircraft noise, and exhaust gases is described along with the tracking and data acquisition support for the Space Shuttle, the Viking lander, and Helios missions. J.M.S.

N76-29055# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1977, VOLUME 1, PART 2

Washington GPO 1976 1278 p refs Hearings on H.R. 11573 (superseded by H.R. 12453) before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., No. 65, 28-29 Jan.; 3-5, 13-14, 16-17, and 19 Feb. 1976
(GPO-70-079) Avail: Subcomm. on Space Sci. and Applications

An overview of NASA space programs is presented. Project planning and management of current and proposed research and test facilities for the various programs is discussed. An assessment of the economic, scientific, and technological benefits to the nation from each of the programs is treated. The various programs that are discussed are: (1) Technology Utilization, (2) the Space Shuttle, (3) Large Space Telescope, (4) Spacelab, (5) Lunar and Planetary Exploration (Viking, Pioneer, and Mariner spacecraft), (6) Space Solar Power, and (7) the Earth Resources program. Federal budgets and a general cost review for the programs are given. Photographs of spacecraft and test facilities are shown. J.R.T.

N76-29056# Committee on Appropriations (U. S. House).
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR 1977, PART 1
Washington GPO 1976 758 p Hearings before a subcomm. of the Comm. on Appropriations, 94th Congr., 2d Sess., 4 Feb. 1976
(GPO-68-927) Avail: Comm. on Appropriations

The hearings concerning the budget for the Department of Transportation are reported. Legislative programs and program obligations are discussed along with the U. S. Coast Guard, FAA, Federal Highway Administration, Amtrak, and the Urban Mass Transportation Administration. The hearings concerning the budget for the National Transportation Safety Board are included. F.O.S.

N76-29057# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1977. PART 4: INDEX
Washington GPO 1976 138 p Hearings on S. 2864 before Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 1976
(GPO-73-502) Avail: Comm. on Aeron. and Space Sci.

An index is presented of the hearings dealing with the NASA authorization for FY-1977. For Vol. 1 see N76-20025. J.M.S.

N76-29058# Committee on Government Operations (U. S. Senate).
ENERGY ADVISORY COMMITTEES
Washington GPO 1975 406 p refs Hearing before Subcomm. on Reports, Accounting, and Management of Comm. on Govt. Operations, 94th Congr., 1st Sess., 1 Aug. 1975
(GPO-59-000) Avail: SOD HC $3.55

Testimony is presented on the activities of the President's Labor-Management Committee dealing with national energy policies. A total of 75 energy advisory committees are included. Pollution control and protection of the environment are emphasized. J.M.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N76-29059 Texas Univ., Austin.
DYNAMICS AND STABILITY OF SEQUENTIAL SYSTEMS Ph.D. Thesis
Paul Arnold Erickson 1975 79 p
Avail: Univ. Microfilms Order No. 76-14444

Car following models have been proposed as a possible control for vehicles on automated highways. In these models the control force on a following vehicle is a function of the relative motion with respect to the preceding vehicle and the absolute motion of the vehicle itself. Such models result in a sequence of differential equations. In previous studies of car following models, the response of a sequence of linear differential equations has been analyzed using a transfer function method. An alternate approach utilizing Liapunov theory is introduced and developed for a general class of linear sequential systems. The method is extended to certain types of nonlinear systems. The results of the Liapunov approach are applied to specific car following models and are compared with previous results obtained using the transfer function method. The Liapunov approach yields additional information which could be of value in the design of automated transportation systems. Dissert. Abstr.

N76-29060*# Denver Research Inst., Colo. Industrial Economics Div.
BENEFITS BRIEFING NOTEBOOK: THE SECONDARY APPLICATION OF AEROSPACE TECHNOLOGY IN OTHER SECTORS OF THE ECONOMY
[1976] 174 p
(Contract NASw-2607)
(NASA-CR-148509; Rept-76/1) Avail: NTIS HC $6.75 CSCL 05A

Resource information on the transfer of aerospace technology to other sectors of the U.S. economy is presented. The contents of this notebook are divided into three sections: (1) benefit cases, (2) transfer overview, and (3) indexes. Transfer examples relevant to each subject area are presented. Pertinent transfer data are given. The Transfer Overview section provides a general perspective for technology transfer from NASA to other organizations. In addition to a description of the basic transfer modes, the selection criteria for notebook examples and the kinds of benefit data they contain are also presented. Author

N76-29061*# Battelle Columbus Labs., Ohio.
CONSIDERATION OF SPACE APPLICATIONS TRANSFER CENTERS FOR THE NASA OFFICE OF APPLICATIONS Final Report
A. C. Robinson, G. E. Wukelic, J. G. Stephan, J. E. Balon, and J. A. Madigan 15 Apr. 1976 32 p
(Contract NASw-2800)
(NASA-CR-148472; BCL-OA-TFR-76-3) Avail: NTIS HC $4.00 CSCL 05A

The concept of Space Applications Transfer Centers is examined to consider the design of the first of these facilities. The questions to be considered are listed. Author

N76-29062*# Denver Research Inst., Colo.
TRANSFER RESEARCH AND IMPACT STUDIES PROGRAM Annual Report
James E. Freeman, ed. Jun. 1975 56 p refs
(Contract NASw-2766)
(NASA-CR-148475) Avail: NTIS HC $4.50 CSCL 05A

Methods developed for stimulating interest in the transfer of NASA-originated technology are described. These include: new information packaging concepts; technology transfer via people transfer; information management systems; data bank operations; and professional communication activities. J.M.S.

N76-29063*# Denver Research Inst., Colo.
SPACE BENEFITS: THE SECONDARY APPLICATION OF AEROSPACE TECHNOLOGY IN OTHER SECTORS OF THE ECONOMY
Nov. 1974 84 p
(Contract NASw-2607)
(NASA-CR-148474) Avail: NTIS HC $5.00 CSCL 05A

Space Benefits is a publication that has been prepared for the NASA Technology Utilization Office by the Denver Research Institute's Program for Transfer Research and Impact Studies, to provide the Agency with accurate, convenient, and integrated resource information on the transfer of aerospace technology to other sectors of the U.S. economy. The technological innovations derived from NASA space programs and their current applications in the following areas are considered: (1) manufacturing consumer products, (2) manufacturing capital goods, (3) new consumer products and retailing, (4) electric utilities, (5) environmental quality, (6) food production and processing, (7)

government, (8) petroleum and gas, (9) construction, (10) law enforcement, and (11) highway transportation. Author

N76-29064*# Princeton Univ., N.J. Center for Environmental Studies and Transportation Program.
SUBURB-TO-SUBURB INTERCITY TRAVEL: ENERGY, TIME AND DOLLAR EXPENDITURES
Margaret Fulton Fels Jun. 1976 70 p refs
(Grant NsG-2037)
(NASA-CR-137911; Rept-76-TR-10) Avail: NTIS HC $4.50 CSCL 13F

The effect of adding suburb to terminal and terminal to suburb travel is examined. The energy consumed in entire trips was estimated. The total energy costs are compared with total travel times, and dollar costs to the traveler. Trips between origins in seven suburbs of Newark, New Jersey and destinations in two Washington, D. C. suburbs are analyzed. Author

N76-29065# Federal Aviation Administration, Washington, D.C.
TECHNICAL ASSISTANCE FOR TRANSPORTATION PLANNERS IN THE US DEPARTMENT OF TRANSPORTATION
Germaine Williams, Norman Ensrud, Gary Maring, and Norman Paulaus Sep. 1975 73 p refs
(AD-A024542/3; FAA-ASP-76-4) Avail: NTIS HC $4.50 CSCL 01/2

The adequacy is evaluated of existing technical assistance efforts aimed at transportation planners in the Department of Transportation and recommendations on how the assistance can be improved are made. A model of a good technical assistance program with two basic components is proposed: (1) a structure consisting of the mechanisms necessary to transmit the technical expertise available to the users and to obtain feedback from them on the program; and (2) the substantive content of the program including the reports and studies generated by research and development efforts and other handbooks, guidelines, etc., of interest to the identified users. The conclusion with respect to structural adequacy is that components of a good technical assistance program are not found clearly identified in UMTA, FAA, or FRA. FHWA does have the necessary structural components of a good technical assistance program, but some improvement could be made in expanding the client group for their assistance. The conclusion with respect to content adequacy is that there are some gaps in the information available from FAA and FRA and that these gaps are not being addressed by the ongoing R and D. Author

N76-29066# Georgia Inst. of Tech., Atlanta. Economic Development Lab.
DISCUSSION PAPERS ON PROBLEMS OF SCIENCE AND TECHNOLOGY. ANNUAL STRATEGY AND PLANNING SYMPOSIUM, AGENCY FOR INTERNATIONAL DEVELOPMENT, OFFICE OF SCIENCE AND TECHNOLOGY
Dec. 1975 122 p refs Symp. held at Atlanta, Georgia, 6-9 May 1975
(Contract AID/TA/C-1194)
(PB-250448/8) Avail: NTIS HC $5.50 CSCL 05B

The Office of Science and Technology of the Agency for International Development periodically holds a symposium on the problems attendant to science and technology in the developing countries. The papers and group discussion summaries included are the product of the third such meeting, held at the Georgia Institute of Technology, in Atlanta, Georgia. This meeting brought together a high-level multidisciplinary group of specialists from national and international agencies and institutions concerned with development policies, with the objective of reviewing past and prospective AID programs in science and technology. GRA

N76-29067# Colorado State Univ., Fort Collins. Environmental Resources Center.
EVALUATION REPORT OF TRAINING PROGRAM ON TRANSFER OF TECHNOLOGY. TRAINING OF GOVERNMENT PERSONNEL IN THE APPLICATION OF THE PRINCIPLES, STANDARDS AND PROCEDURES FOR PLANNING OF THE WATER RESOURCES COUNCIL
Douglas D. Sjogren and Robert D. Wittman Dec. 1974 98 p refs
(Contract DI-14-31-0001-4260)
(PB-250965/1; W76-05349; OWRT-X-143(4260)) Avail: NTIS HC $5.00 CSCL 05I

An evaluation report is presented on a training program for government personnel in technology transfer, involving three features: context, with concentration on program development, participant and staff characteristics, and training setting; transactions or information processing, defining the training procedures; and outcomes, focussed on content, attitudes, and the acquisition of knowledge. GRA

N76-29068# Washington State Dept. of Highways, Olympia.
GUIDELINES FOR THE IDENTIFICATION AND MEASUREMENT OF SOCIAL FACTORS IN TRANSPORTATION PLANNING Final Report, 1 Oct. 1972 - 30 Jun. 1976
Jun. 1976 29 p
(PB-250991/7; RPR-25.2) Avail: NTIS HC $4.00 CSCL 13B

Guidelines and procedures for the measurement of the social effects of transportation systems and facilities on both a regional and community or neighborhood level are developed. A detailed examination of the seven-fold classification scheme of social factors and an emphasis on the methodologies used to evaluate social impacts is discussed. Emphasis is placed on the analytical framework utilizing the major phases of inventorying existing social conditions, identifying potential changes and measurement of probable impacts. From this analysis a systematic approach to identifying and measuring social impact in transportation planning is put forth, for use by those assigned this responsibility. GRA

N76-29069# Carnegie-Mellon Univ., Pittsburgh, Pa. Transportation Research Inst.
A STRATEGY FOR THE EVALUATION OF ALTERNATIVE URBAN TRANSPORTATION SYSTEMS WITH MULTIDIMENSIONAL CONSEQUENCES
Feng-Bor Lin Sep. 1974 174 p refs Sponsored by DOT
(PB-251179/8; CMUTRI-TP-74-21; UMTA-PA-11-0007-74-4)
Avail: NTIS HC $6.75 CSCL 13B

The validity of existing evaluation techniques potentially suitable for dealing with the problems involving multidimensional consequences of urban transportation systems is examined. The development of an evaluation model in the context of additive utilities for unifying value judgements in search of the best alternative transportation plan is reported. Four basic evaluation models are identified for comparative analysis. The focus of the analysis is on the theoretical soundness of the models and on the sensitivities of the models with respect to the number of alternatives encountered, to the distribution of outcome states, and to the addition or the reduction of the number of alternatives from the original set. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-29070 California Inst. of Tech., Pasadena.
THE STELLAR COMPOSITION AND EVOLUTION OF IRREGULAR AND OTHER LATE-TYPE GALAXIES Ph.D. Thesis
William George Bagnuolo, Jr. 1976 143 p
Avail: Univ. Microfilms Order No. 76-16372

The stellar content and history of star formation of a number of irregular and other late-type galaxies were analyzed by means of 10-color photometry of the galaxies and a comparison of their colors to the calculated colors of a set of three parameter models. The galaxy models are assumed to be composed of

various amounts of clusters from one million to ten billion years old, the colors of which were calculated from stellar-evolutionary tracks and observations of 102 stars of all spectral types. The colors of the model clusters were checked by comparison to the colors of 46 clusters in the Magellanic Clouds. The principal results, the analysis of the galaxies; a description of the cluster models and comparison to the cluster observations; and the colors of the 102 calibrating stars are presented. Dissert. Abstr.

N76-29071 California Univ., Berkeley.
MODEL H2 REGIONS AND IONIZATION FRONTS Ph.D. Thesis
Jesse King Hill 1975 112 p
Avail: Univ. Microfilms Order No. 76-15218

Uniform pressure model HII regions were constructed for different pressures, heavy element abundances, stellar temperatures, and assumptions about the far ultraviolet opacity of dust grains. These models were used to investigate the dependence of observable emission line strengths upon heavy element abundances. The ionization structures of the trace elements C, N, O, Ne, Si, and S were also computed. The frequency dependence of the line profiles of radio recombination lines were studied and a test of the expanding nebula hypothesis proposed. It was found that ionization fronts are closely related to phase boundaries. Model ionization fronts for several different velocities were constructed and tested for thermal stability. Only very low velocity fronts show instability. In these cases, thermal conduction may stabilize the front. The formation of molecular hydrogen in ionization fronts was also studied, and the influence of the exciting star on the region outside the nebula was examined.
Dissert. Abstr.

N76-29072 California Inst. of Tech., Pasadena.
COMPACT INFRARED SOURCES: NGC 7538 AND THE GALACTIC CENTER Ph.D. Thesis
Steven Paul Willner 1976 68 p
Avail: Univ. Microfilms Order No. 76-16380

Infrared and radio sources in NGC 7538 were observed. The very small southern source shows a deep silicate absorption feature at 9.7 microns while the northern extended source shows little or no silicate absorption, but has a 12.8-micron emission line from Ne II. The data imply that the compact source has a gas to dust ratio of 75 inside the ionized region. A revised 10-micron map of the Galactic center and photometry of individual sources were also obtained. It was concluded that: (1) the five sources with the bluest energy distributions between 1.6 and 3.5 microns are stars or star clusters, (2) there is extended emission from ionized gas and dust, (3) the density of ionized gas in the discrete 10 micron sources is no higher than that in the extended source, (4) there is at least one compact source that is not associated with the others, and (5) most of the extinction observed is interstellar and moderately uniform.
Dissert. Abstr.

N76-29073 Massachusetts Univ., Amherst.
MICROWAVE SPECTRAL-LINE RADIATION FROM YOUNG AND EVOLVED STELLAR OBJECTS Ph.D. Thesis
Kenneth Paul Bechis 1976 276 p
Avail: Univ. Microfilms Order No. 76-14632

A new type of OH emission source was detected from the Orion-Population star V1057 Cygni. The position of the OH emitting region was determined interferometrically to coincide within 1 sec with the star position. Narrow emission lines from the J = 1 - 0 rotational transitions of (C-12)(O-16) and (C-13)(O-16) were observed in the region of V1057 Cyg and its reflection nebula. Emission-line stars of the Orion Population were searched for OH and H2O emission. No H2O emission was detected, and only four OH sources were detected, though none had OH-emission intensities comparable to the V1057 Cyg OH source. Narrow emission lines from the J = 1 - 0 (C-12)(O-16) and (C-13)(O-16) rotational transitions were observed in the vicinities of FU Orionis and its cometary nebula, and the young cluster NGC 7129. Evolved stars with circumstellar dust shells were surveyed for (C-12)(O-16) and or H(C-12)(N-14) emission. Finally, (C-12)(O-16) emission was detected from the peculiar infrared objects CRL 2688 and CRL 618. Dissert. Abstr.

N76-29074 Arizona Univ., Tucson.
THIRTEEN-COLOR PHOTOMETRY OF SUBDWARFS Ph.D. Thesis
William John Schuster 1976 239 p
Avail: Univ. Microfilms Order No. 76-16234

Narrow and intermediate band photometry for 119 subdwarfs and for over 50 Hyades dwarfs was obtained. The metal-poor subdwarfs were compared to the Hyades dwarfs at constant effective temperature to obtain blanketing curves for studying the metallicity sensitivity of the 13-color indices. Field giants were compared to the Hyades dwarfs to obtain luminosity-difference curves. Metallicity, gravity, and temperature indices were obtained. These indices were then calibrated for measuring stellar atmospheric parameters. Using these calibrations the effective temperatures and metal contents for most of the subdwarfs were determined. The positions of the subdwarfs in the (M sub bol, T sub e) and (G, 45-63) diagrams were studied as a function of metal content. The (G, 45-63) diagram also provided an even clearer picture of the extreme subdwarfs' evolution. Finally, the (M sub bol, T sub e) and (G, 45-63) diagrams were used together to estimate subdwarf masses as a ratio to Hyades masses at constant temperature. Dissert. Abstr.

N76-29075 Arizona Univ., Tucson.
SURFACE PHOTOMETRY OF INTERACTING GALAXIES Ph.D. Thesis
Thomas Anthony Sargent 1976 146 p
Avail: Univ. Microfilms Order No. 76-16240

Computer simulations were performed to test dynamic models of interacting galaxies by adding a true disk potential to the gravitational field and by studying the effects of the addition of varying degrees of velocity dispersion to the stellar component. These experiments showed that true bridges are fairly sensitive, while tails are more resistant to disruption. Analysis of velocity dispersions in formed filaments demonstrated that the interaction is best characterized as continuous distortion and smooth flow. Generally, it was concluded that the results tend to strengthen the simple dynamical model. B-V surface photometry of three interacting galaxies (Arp 174, NGC 2648, and NGC 4676) was obtained using a digicon tube. The primary common feature of these systems is that they all show some anomalously red regions. In the case of the two spiral systems it is likely that this is due to dust. An extremely young blue population I is probably not present. Dissert. Abstr.

N76-29076 California Inst. of Tech., Pasadena.
THE STRUCTURE OF HYDROXYL MASERS AND CIRCUMSTELLAR ENVELOPES OF LONG PERIOD VARIABLE STARS Ph.D. Thesis
Mark Jonathan Reid 1976 144 p
Avail: Univ. Microfilms Order No. 76-16377

A statistical analysis of spectral line velocities in an ensemble of long period variable stars is presented for optical emission and absorption lines and for radio OH maser emission lines. The results indicate that the optical absorption and high velocity OH emission line velocities are red-shifted with respect to the stellar radial velocity. Very long baseline interferometric observations of the OH maser emission in long period variable stars such as IRC + 10011, U Ori and R Aql indicate that the apparent sizes of the OH maser components in long period variable stars are greater than or about 5 x 10 to the 15th power cm. Analysis of data obtained on IRC + 10011 and VY CMa indicate that the two emission complexes probably are separated by distances less than, or comparable to, the extent of the emission in either complex. These and other findings suggest that OH emission from long period variable stars comes from a series of concentric, inhomogeneous, circumstellar shells expanding from the central star. Dissert. Abstr.

N76-29077 Texas Univ., Austin.
MILLIMETER WAVELENGTH MOLECULAR EMISSION ASSOCIATED WITH THE YOUNG HERBIG Be AND Ae STARS Ph.D. Thesis
Robert Bruce Loren 1975 250 p
Avail: Univ. Microfilms Order No. 76-14888

The detection of interstellar molecular emission from the J = 1 yields 0 rotational transition of CO at 2.6 mm from dust clouds surrounding the Herbig Be and Ae stars is reported. The

peak emission intensity is coincident with the position of the star in most of these clouds indicating heating of the interstellar gas surrounding these stars. Furthermore the opacity is larger in the vicinity of these stars indicating an increased density near the stars. Emission was detected in the regions of highest density from CS, HCN, H2CO and SO molecules. In the molecular clouds associated with R CrA, LkH alpha 198, and possibly NGC 7129 there is an increase of velocity dispersion in the (C-12)(O-16) line profiles from positions close to the star. Cloud models proposed to account for line formation in molecular clouds are discussed. Only the nonhomologous collapse with V proportional to the square root of accounts for both the CO peak emission at the stellar position and the broadening of the CO lines near the star. Dissert. Abstr.

N76-29078 California Univ., Berkeley.
AN INFRARED STELLAR INTERFEROMETER USING HETERODYNE DETECTION Ph.D. Thesis
Michael Allan Johnson 1975 192 p
Avail: Univ. Microfilms Order No. 76-15240

A two-element steller interferometer, operating with two 10 microns wavelength heterodyne receivers on a baseline of 5.5 m was constructed and successfully tested on signals from an astronomical source. The angular resolution of the instrument for sources on the meridian is 0.2 arc seconds. Preliminary measurements of atmospheric stability coupled with reasonable expectations of improvements in receiver sensitivity lead to the conclusion that the infrared heterodyne interferometer will be capable of making high angular resolution measurements of the sizes and positions of a large number of infrared sources and perhaps contribute answers to such astronomical problems as the gravitational deflection of light or the presence of planetary systems around stars other than our sun. Dissert. Abstr.

N76-29079 Wisconsin Univ., Madison.
OBSERVATIONS OF COMET KOHOUTEK (1973f) WITH A FABRY-PEROT SPECTROMETER Ph.D. Thesis
David A. Huppler 1976 111 p
Avail: Univ. Microfilms Order No. 76-10663

Diffuse emissions from Comet Kohoutek (1973f) were observed with a Fabry-Perot spectrometer using the McMath Solar Telescope at Kitt Peak National Observatory in Arizona. A single resolving etalon with a diameter of 150 mm was operated at a resolution of 40,000. On December 3, 1973 the first positive identification of hydrogen alpha emission from a comet was made. Subsequent observations yielded an extensive plot of the hydrogen production rate versus sun-comet distance. The average of the production rates for the preperihelion comet at a sun-comet distance of 0.7 AU to 0.8 AU was 1.8(+ or - 0.4) x 10 to the 29th power hydrogen atoms/sec. The mean velocity was deconvolved as 7.8 (+ or - 0.2) km/sec. Observations of [OI]Lambda6300 yielded a production rate for singlet oxygen atoms at a sun-comet distance of 0.7 AU of 1.0(+ or - 0.3) x 10 to the 28th power atoms/sec. Production rates at other sun-comet distances were determined. The oxygen velocity was deconvolved as 1.35(+0.50, -0.65) km/sec. Dissert. Abstr.

N76-29080 California Univ., Berkeley.
OPTICAL OBSERVATIONS OF COMPACT X-RAY SOURCES Ph.D. Thesis
Arthur Falnes Davidsen 1975 147 p
Avail: Univ. Microfilms Order No. 76-15154

Research progress in optical studies of compact galactic X-ray sources conducted at Lick and Leuschner Observatories of the University of California is reported. Results of this program include the identification of the X-ray pulsar Hercules X-1 with the unusual variable star HZ Herculis and the discovery of low amplitude optical pulsations from the system. The X-ray source 3U 0614+09 was optically identified with an 18th magnitude blue star which is similar to the optical counterpart of Sco X-1. An extensive search for the optical counterparts of nine compact X-ray sources near the galactic center is also described. Several interesting candidates have been observed, including a peculiar strong emission line object likely to be associated with 3U 1728-24. A detailed investigation of the energy distribution of the optical pulses in HZ Her was carried out. A theoretical model for old population binary X-ray sources was developed and applied to explain to the observed features of Cygnus X-3. In addition to explain X-ray and infrared variability of Cyg X-3, the model also provides a natural explanation of several features of the radio outbursts which this source displays. Dissert. Abstr.

N76-29081 Illinois Univ., Urbana.
PHOTOMETRIC OBSERVATIONS OF VISUAL BINARIES AND INFERENCES CONCERNING MIXING IN RED GIANTS Ph.D. Thesis
Leo Drake Deming 1976 204 p
Avail: Univ. Microfilms Order No. 76-16117

The DDO and uvby beta methods photometry were used to study a sample of visual binaries. Inferences were made concerning the amount and kind of mixing which occurs in population I red giants before and during the stage of core helium burning. The binaries consist of G and K giants in association with main sequence stars of nearly solar type. The DDO photometry of the giant components of the binaries yields absolute magnitudes which are in generally good accord with the absolute magnitudes derived for the secondary components from uvby beta photometry. The spectral types indicated by DDO photometry are in generally good agreement with spectral types given by visual classification. However there exists a small group of stars for which DDO photometry gives widely discrepant spectral types and absolute magnitudes. These stars can often be noticed to have peculiar spectra at the time of visual classification; they may be spectroscopic binaries but this is not certain.
Dissert. Abstr.

N76-29082 Texas Univ., Austin.
A STUDY OF EXTRAGALACTIC RADIO SOURCES WITH VARIABLE FLUX DENSITY AT 365-380 MHz Ph.D. Thesis
William Donaldson Cotton 1975 147 p
Avail: Univ. Microfilms Order No. 76-14429

Extragalactic radio sources with variable flux densities at 365-380 MHz were studied. Of about 1500 radio sources between declinations +13 deg and +50 deg, 816 sources were sufficiently strong, well enough observed and small enough that variability on the order of 30-50% could be detected. A short baseline synthesized aperture interferometer was used to determine total flux densities for detection of extended structure around the variable sources and to provide a sample of sources to determine the frequency of occurrence of variability. The observations indicate that low frequency variability is fairly common, at least 1% of all extragalactic radio sources are observed to have strong variations at low frequency. In addition, extended structure appears to be common around variable sources. Finally, several geometrical focusing models are proposed which can reproduce several observed properties of low frequency variable sources.
Dissert. Abstr.

N76-29083*# Planetary Science Inst., Tucson, Ariz.
PLANETARY ASTRONOMY PROGRAM
15 Feb. 1976 62 p refs
(Contract NASw-2843)
(NASA-CR-148460; QR-2) Avail: NTIS HC $4.50 CSCL 03A

Visual photometric function data for Saturn's rings were analyzed in terms of elementary anisotropic scattering radiative transfer models which involve the Henyey-Greenstein function. Limits were placed on the combinations of single scattering albedo, and backscattering directivity, which are permitted by observation. Particles with lunar-like scattering properties were excluded by the analysis. Results are consistent with the ring particles being more-or-less pure, and spherical, conglomerates of H2O frost. Multicolor (5500 A-7600 A), narrow band (100 A), area scanning photometry was used to study the wavelength variation in the optical appearance of Uranus. Limb brightening was detected in two CH4 bands, i.e. 6190A and 7300A. Spectrophotometric observations and analysis of the asteroids and Raman spectroscopy of the atmosphere of Uranus are also briefly discussed. Author

N76-29084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HOT INTERSTELLAR TUNNELS. 1: SIMULATION OF INTERACTING SUPERNOVA REMNANTS
Barham W. Smith May 1976 66 p refs Revised Prepared in cooperation with Wisconsin Univ.
(Grant NGL-50-002-044)
(NASA-TM-X-71148; X-661-76-119) Avail: NTIS HC $5.00

CSCL 03A

The theory required to build a numerical simulation of interacting supernova remnants is developed. The hot cavities within a population of remnants will become connected, with varying ease and speed, for a variety of assumed conditions in the outer shells of old remnants. Apparently neither radiative cooling nor thermal conduction in a large-scale galactic magnetic field can destroy hot cavity regions, if they grow, faster than they are reheated by supernova shock waves, but interstellar mass motions disrupt the contiguity of extensive cavities necessary for the dispersal of these shocks over a wide volume. Monte Carlo simulations show that a quasi-equilibrium is reached in the test space within 10 million yrs of the first supernova and is characterized by an average cavity filling fraction of the interstellar volume. Aspects of this equilibrium are discussed for a range of supernova rates. Two predictions are not confirmed within this range: critical growth of hot regions to encompass the entire medium, and the efficient quenching of a remnant's expansion by interaction with other cavities. Author

N76-29085*# New Mexico State Univ., Las Cruces.
CONTRIBUTIONS OF THE OBSERVATORY OF NEW MEXICO STATE UNIVERSITY, VOLUME 1, NO. 4, APRIL 4
Apr. 1976 84 p refs
(Grants NGL-32-003-001)
(NASA-CR-148486) Avail: NTIS HC $5.00 CSCL 03A

Papers are presented dealing with astronomical observations of the Jupiter Red Spot, Corona Borealis Constellation, and Meteoroids. Calibration of instruments and reduction and analysis of data are discussed. For individual titles, see N76-29086 through N76-29095.

N76-29086* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
NON-LTE PROFILES OF STRONG SOLAR LINES c92
T. J. Schneeberger and H. A. Beebe *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4, Apr. 1976 p 110-122 refs (For availability see N76-29085 19-89)
(Grant NSF LP-43815)
CSCL 03A

The complete linearization method is applied to the formation of strong lines in the solar atmosphere. Transitions in Na(I), Mg(I), Ca(I), Mg(II), and Ca(II) are computed with a standard atmosphere and microturbulent velocity model. The computed profiles are compared to observations at disk center. Author

N76-29087* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
EMISSIVITIES AND DETECTABILITY OF THE PURE ROTATIONAL TRANSITIONS OF MOLECULAR HYDROGEN
Timothy J. Schneeberger *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 123-133 refs Supported in part by NSF (For availability see N76-29085 19-89)
CSCL 03A

The emissivities of the infrared rotational transitions of H2 are calculated for temperatures from 10 K to 6000 K. The calculations are made for several ratios, R, of Para (J=0) to Ortho (J=1)H2. The possibility of detecting these transitions in interstellar molecular clouds is discussed. Author

N76-29088* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
PHOTOMETRY OF R CORONAE BOREALIS
Dennis W. Dawson and Edward F. Tedesco *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 134-139 refs (For availability see N76-29085 19-89)
CSCL 03A

Visual and photoelectric observations of R Coronae Borealis are presented, including a number of observations surrounding the 1974 minimum. The recent visual history of the variable is examined and the discrete cloud obscuration model is considered. Author

N76-29089*# New Mexico State Univ., Las Cruces. Dept. of Astronomy.
INTERMEDIATE-BAND PHOTOMETRY OF FAINT STANDARD STARS
Dennis W. Dawson *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 140-142 refs (For availability see N76-29085 19-89)
CSCL 03A

The David Dunlap Observatory system uses six intermediate-band filters whose central wavelengths were chosen to cover important features in the spectrum of a late-type star. Calibrations of the color indices with physical parameters, allow one to estimate T sub eff, log g, [Fe/H], M sub v and reddening directly from the photometry. Although a number of standards lists exist, only a small fraction of the stars is fainter than V=6. It is desirable to add to the numbers of faint standards. Results are presented of photometry of sixteen stars obtained during a program of variable-star photometry at Blue Mesa Observatory. Author

N76-29090* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
SEYFERT GALAXIES: A STUDY OF BRIGHTNESS VARIATION AND STELLAR CONCENTRATION
Dennis W. Dawson *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1 No. 4 Apr. 1976 p 143-147 refs (For availability see N76-29085 19-89)
CSCL 03A

Ultraviolet photometry of Seyfert galaxies is analyzed for variations in nuclear magnitude. Using multiple apertures permits the estimation of stellar concentration; four Seyfert and two normal spiral galaxies are compared. Author

N76-29091* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
TESTING OF A PHOTOELECTRIC PHOTOMETER. 1: DETERMINATION OF OPERATIONAL PARAMETERS c35
Dennis W. Dawson and Edward F. Tedesco *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 148-153 refs (For availability see N76-29085 19-89)
CSCL 14B

Observations over four months are used to evaluate magnitude and color transformations, extinction coefficients, and a gain table for the photoelectric photometer of the 41 cm. reflector at the Tortugas Mountain site. Ways of increasing the efficiency and accuracy of this system are discussed. Author

N76-29092* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
TESTING OF A PHOTOELECTRIC PHOTOMETER. 2: OBSERVATIONAL TESTING c35
Dennis W. Dawson and Edward F. Tedesco *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 154-158 ref (For availability see N76-29085 19-89)
CSCL 14B

The versatility is demonstrated of the 41 cm. Tortugas reflector's photoelectric system through observations of V566 Oph and R CrB with four associated AAVSO comparison stars. These observations were made between May and October, 1974. Author

N76-29093* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
PHOTOMETRIC CALIBRATION OF PLANETARY PHOTOGRAPHS c35
Reta F. Beebe *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 159-163 ref (For availability see N76-29085 19-89)
CSCL 14E

The basic data and approach for calibrating photographic plates obtained with the 61 cm telescope at the Tortugas Mountain Station of New Mexico State University are summarized. Since this is the fundamental calibration of planetary data it is of use to all in-house users as well as other individuals who use the data. Author

N76-29094* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE NASA-NMSU AUTOMATED METEOR OBSERVATORY
Gale A. Harvey and James Cuffey (New Mexico State Univ.) *In* N. Mex. State Univ. Contrib. of the Observatory of N. Mex. State Univ., Vol 1, No. 4 Apr. 1976 p 166-173 refs (For

availability see N76-29085 19-89)
CSCL 03A

A new observatory for meteor research which provides data for study of meteor heights, velocities, orbits, and meteoroid abundances is described. The observing equipment is automated to take advantage of the long periods of favorable observing weather common to the region. Four K-24 cameras, electrically operated, provide the triangulation observations, and four Maksutov f/1.3 cameras with blazed transmission grating provide spectral coverage. The patrol cameras have operated for a year and a half, and approximately 6,000 frames have been exposed by 9 March 1975. Meteor trails appear on 260 of these frames. Sixty-eight trails are of meteors photographed from two locations and thus allow trajectory and orbit determinations for 34 meteors. Photoelectric sensors initiate the 2-second spectrograph exposures, and electrical controls open and close the observatory at present times. Author

N76-29095* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
MEASUREMENTS OF JUPITER'S LONG-LIVED FEATURES AND CURRENTS **c91**
E. J. Reese and Reta F. Beebe *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 176-190 refs (For availability see N76-29085 19-89)
(Grants NGL-32-003-001; NSF MPS-75-03734)
CSCL 03B

Recent longitudinal measurements of Jupiter's Red Spot are presented to illustrate the constancy of the 90-day oscillation. Observational parameters of the Red Spot, the three south temperate ovals, and a summary of the zenographic latitudes of the belts are tabulated for the time interval from 1972 to 1975. Drift rates and the mean latitudes of the atmospheric currents for the 1974-75 apparition are presented. Author

N76-29096*# Hulburt (E. O.) Center for Space Research, Washington, D.C.
APOLLO 16 FAR-ULTRAVIOLET IMAGERY AND SPECTRA OF THE LARGE MAGELLANIC CLOUD
Thornton Page and George R. Carruthers 15 Jun. 1976 19 p refs Presented at the 19th Meeting of COSPAR, Philadelphia, 15 Jun. 1976
(NASA Order H-1304-3B)
(NASA-CR-148359; COSPAR-Paper-3A:1.8) Avail: NTIS HC $3.50 CSCL 03A

The Large Magellanic Cloud was observed by the far ultraviolet camera spectrograph from the lunar surface during the Apollo 16 mission 22 April 1972. Images were obtained with about 3 arc min resolution, in the 1,050 to 1,600 and 1,250 to 1,600 A wavelength ranges, of nearly the entire LMC. Spectra were also obtained in the 1,050 to 1,600 and 900 to 1,600 A ranges along a strip 1/4 deg wide (determined by the instrument's grid collimator) passing across the LMC. The images and spectra have been scanned with a PDS microdensitometer, and isodensity contour plots have been prepared using the Univac 1108 computer. Author

N76-29097*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WINDOW: A COMPUTER PROGRAM FOR PLANNING ASTRONOMICAL OBSERVATIONS
E. F. Erickson and S. Matthews Jul. 1976 14 p
(NASA-TM-X-73156; A-6697) Avail: NTIS HC $3.50 CSCL 03A

A FORTRAN computer program called WINDOW was written to simplify the planning of astronomical observations of a number of objects in a limited time. The program lists the azimuths at 15 minute intervals of up to 20 objects while they are in a given range of elevation angles - the window - and gives the elevation angle of each object at its time of transit. This work was motivated by the need to use observing time efficiently on flights of NASA-Ames' Lear Jet and C-141 observatories; WINDOW permits the investigator to prepare preliminary flight plans. However, the program is suited to planning ground-based observations as well. The program and a sample flight plan are described. Author

N76-29098*# Kanner (Leo) Associates, Redwood City, Calif.
ORBITS ABOUT THE SUN INTENDED FOR RADIOSONDE OBSERVATIONS OF THE SOLAR SPACE
G. A. Mersov Washington NASA Aug. 1976 14 p refs Transl. into ENGLISH from the book "Opredeleniye Dvizheniya Kosmicheskikh Apparatov" Moscow, Nauka Press, 1975 p 115-122
(Contract NASw-2790)
(NASA-TT-F-17127) Avail: NTIS HC $3.50 CSCL 03B

The problem of obtaining an orbit about the sun whose orbital elements coincide with the elements of the earth's orbit is examined. The perihelion argument of the former differs from that of the latter by 180 degrees. If the probe is placed into a heliocentric orbit that is symmetrical to the earth, then the earth, sun and probe will be always situated on a straight line. This is termed the antiterrestrial orbit. Two schemes of achieving such an orbit with the aid of two intermediate orbits are proposed. It is assumed that all maneuvers are executed instantaneously, that both the earth and the probe move only in the gravitational field of the sun, and that the earth's sphere of influence is negligible compared with the distance between the earth and the sun. Author

N76-29099*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LINE IDENTIFICATIONS IN THE ULTRAVIOLET SPECTRA OF TAU HERCULIS, B5 IV, AND ZETA DRACONIS, B6 III
Anne B. Underhill and Saul J. Adelman (Boston Univ., Mass.) Aug. 1976 125 p refs Submitted for publication
(NASA-TM-X-71167; X-670-76-173) Avail: NTIS HC $5.50 CSCL 03A

Tables of the lines found on two tracings each of the ultraviolet spectrum of Tau Her, B5 IV, and Zeta Dra, B6 III, made by the Copernicus satellite and possible identifications are given. The ranges 1025-1451A for Tau Her and 1035 to 1425A for Zeta Dra are covered by the U2 spectrometer at a resolution of 0.2A; the ranges 2028 to 2959A for Tau Her and 2000 to 3000A for Zeta Dra are covered by the V2 spectrometer at a resolution of 0.4A. The observed density of lines in the U2 region is 1.1 lines/A for Tau Her and 1.7 lines/A for Zeta Dra. In the V2 region it is 0.8 lines/A for Tau Her and 0.9 lines/A for Zeta Dra. Author

N76-29100*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REQUIREMENTS AND SPECIFICATIONS OF THE SPACE TELESCOPE FOR SCIENTIFIC OPERATIONS
D. K. West Mar. 1976 36 p
(NASA-TM-X-71160; X-604-76-82) Avail: NTIS HC $4.00 CSCL 03A

Requirements for the scientific operations of the Space Telescope and the Science Institute are used to develop operational interfaces between user scientists and the NASA ground system. General data systems are defined for observatory scheduling, daily science planning, and science data management. Hardware, software, manpower, and space are specified for several science institute locations and support options. Author

N76-29118* Center for Astrophysics, Cambridge, Mass.
VERY HIGH ENERGY GAMMA RAY ASTRONOMY
J. E. Grindlay *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 85-107 refs (For availability see N76-29110 19-90)
(CFA/HEA-76-138) CSCL 03A

N76-29119* Stanford Univ., Calif. Inst. for Plasma Research.
RADIATION MECHANISMS AND MAGNETOSPHERIC STRUCTURE OF PULSARS
P. A. Sturrock and K. B. Baker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 108-117 refs (For availability see N76-29110 19-90)
CSCL 03A

N76-29120* Middle East Technical Univ., Ankara (Turkey).
GAMMA RAY PULSARS
H. Oegelman, S. Ayasli, and A. Hacinliyan *In* NASA. Goddard

Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 118-127 refs (For availability see N76-29110 19-90)
CSCL 03A

N76-29129* Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
GALACTIC DISTRIBUTION OF PULSARS
J. H. Seiradakis *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 299-319 refs (For availability see N76-29110 19-90)
CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-29101 California Univ., Berkeley.
OBSERVATIONS OF THE J = 2 YIELDS 1 TRANSITION OF CARBON MONOXIDE IN INTERSTELLAR CLOUDS Ph.D. Thesis
Paul Felix Goldsmith 1975 142 p
Avail: Univ. Microfilms Order No. 76-15193

A spectral line radiometer system for operation at a wavelength of 1.3 mm was constructed. Observations were made of the (C-12)O J = 2 yields 1 line in nine astronomical sources. The (C-13)O J = 2 yields 1 line was measured in three molecular clouds-Orion A, NGC 2024, and OMC 2. The (C-12)(O-18) J = 2 yields 1 line was searched for, but not detected in Orion A. The temperatures of the (C-12)O J = 1 yields 0 lines are equal to or slightly lower than those of the corresponding J = 1 yields 0 lines. The (C-13)O J = 2 yields 1 lines are also approximately equal in intensity to the J = 1 yields 0 lines. The non-detection of the J = 2 yields 1 line of the (C-12)(O-18) species in Orion A places an upper limit on the hydrogen density of between 2,000/cu cm and 4,000/cu cm, depending on the kinetic temperature in the cloud, for that component which is optically thin. A model for the central region of the Orion A molecular cloud is proposed in which high density clumps occupying a few percent of the volume are embedded in a low density interclump medium. Dissert. Abstr.

N76-29102 California Univ., Berkeley.
STUDIES IN THEORETICAL ASTROPHYSICS: DIFFUSE GALACTIC RADIATION, COSMIC-RAY ELECTRONS, AND THE CRAB NEBULA Ph.D. Thesis
Stephen Lee Weinberg 1975 100 p
Avail: Univ. Microfilms Order No. 76-15418

The galactic ridge is interpreted as a population of intrinsically weak X-ray sources, and calculations are presented of the predicted intensity as a function of scale height and radial gradient. It is shown that data from muon-poor earth air showers indicate that the cosmic-ray electron spectrum does soften at a few hundred GeV. This situation rules out theories of a magnetobremsstrahlung origin for the diffuse galactic X-rays. A two-component theory is suggested for the X-rays with an inverse Compton contribution and a discrete, unresolved source contribution. A simple particle diffusion theory with a finite injection region is described which agrees in detail with the optical isophotal and spectral data on the Crab Nebula. An extrapolation yields the predicted X-ray surface brightness. The nebula and pulsar parameters are derived on the basis of a magnetic dipole radiating Crab pulsar.
Dissert. Abstr.

N76-29103 California Univ., Berkeley.
THE INTERACTION OF GAS AND GALAXIES WITHIN GALAXY CLUSTERS Ph.D. Thesis
Jill Cornell Tarter 1975 281 p
Avail: Univ. Microfilms Order No. 76-15387

Ramifications of the presumed presence of intergalactic intra-cluster gas in sufficient quantities to bind groups and clusters of galaxies were studied. Observational data on the intensity and isotrophy of the extragalactic component of the diffuse X-ray background severely restrict the amount of hot plasma which may be present in rich clusters of galaxies; however, the bulk of the required binding mass may be present as somewhat cooler ionized clouds. Detailed observations of the Coma cluster exclude the possibility of a significant portion of the cluster mass being in the form of ionized gas at any temperature. The combined emission, absorption and dynamical constraints on any intergalactic gas limit the allowed forms for the missing mass to highly condensed objects: black holes of small mass, neutral and/or molecular clouds of hydrogen which are rapidly rotating and highly flattened or some type of extreme dwarf stellar population. Dissert. Abstr.

N76-29104 Oregon Univ., Eugene.
A MAXIMAL BACKGROUND SPECTRUM OF GRAVITATIONAL RADIATION AND POLARIZED SYNCHROTRON RADIATION IN MAGNETIC WHITE DWARFS Ph.D. Thesis
Leonard Angelo Rosi 1975 94 p
Avail: Univ. Microfilms Order No. 76-15054

A maximal spectrum of gravitational radiation from extragalactic sources was calculated and compared with the spectrum of sources and events inside of our galaxy and with theoretical levels of proposed detectors. It was found that this maximal background spectrum can be distinguished from the spectrum of sources within our galaxy and is within the realm of proposed detectors. From minimal considerations of this spectrum it was determined that the density of gravitational radiation is probably rho > or = 10 to the minus 39th power gm/cu cm. The background spectrum is sensitive to the upper mass limits and mass distribution of stars in galactic models, and therefore, it could provide information about galactic evolution. In addition, synchrotron radiation from electrons trapped in a stellar magnetic field was investigated as a possible source of the optical polarization found in white dwarfs. The Stokes parameters of synchrotron radiation were determined for a dipole magnetic field with parameterized spatial and energy distributions of electrons.
Dissert. Abstr.

N76-29105 California Univ., Berkeley.
STELLAR MOTIONS IN EARLY-TYPE GALAXIES Ph.D. Thesis
Charles John Peterson 1975 172 p
Avail: Univ. Microfilms Order No. 76-15339

Numerical techniques were developed to measure projected rotation curves and velocity dispersions from absorption lines in the spectra of early-type stellar systems. Relative velocities are determined from the position of the peak of the cross-correlation of two spectral traces. A method for measurement of velocity dispersions by comparison of the power spectra of the data is discussed. The methods rely heavily on the use of the fast Fourier transform algorithm. The techniques were applied to spectral data of eleven elliptical galaxies, one S0, and the nuclear region of two spiral galaxies. With three exceptions, only solid-body rotation was observed in the early-type galaxies. The central angular velocities correlate with total magnitude in the sense that the brightest galaxies have the smallest angular rotation. In some early-type galaxies, the rotation plays a significant part in determining the density structure. Dissert. Abstr.

N76-29106 Texas Univ., Austin.
GRAVITATIONAL COLLAPSE OF A NON-SPHERICAL MASS: A NUMERICAL APPROACH Ph.D. Thesis
Thomas Benjamin Criss 1975 67 p
Avail: Univ. Microfilms Order No. 76-14431

In general relativity, the future evolution of a spacetime can be predicted if the three metric of some spacelike hyper-surface and its time derivatives are known. This initial data cannot be chosen freely but must satisfy four equations of constraint. A method is described for generating valid initial data for gravitational systems containing matter. A specific solution to the constraint equations is used as initial data for a computer simulation of the gravitational collapse of a compact object. Various numerical embedding programs are used to picture the future evolution of the three metric in order to gain a better understanding of the actual dynamics of the system. Dissert. Abstr.

N76-29107 California Univ., Berkeley.
COOLING OF INTERSTELLAR FORMALDEHYDE BY

COLLISION WITH HELIUM: AN ACCURATE QUANTUM MECHANICAL CALCULATOR Ph.D. Thesis
Barbara Jane Garrison 1975 71 p
Avail: Univ. Microfilms Order No. 76-15188

In order to test a collisional pumping model as a mechanism for cooling the 6 cm and 2 cm doublets of interstellar formaldehyde, a quantum mechanical scattering calculation is performed. To obtain the intermolecular interaction between H2CO and He two calculations are performed a Hartree-Fock (HF) potential surface and a configuration interaction (CI) surface. An Arthurs and Dalgarno type coupled channel (CC) formalism is presented for scattering of an asymmetric top by an atom. These CC equations are integrated at 12 scattering energies between 20 and 95 K. For the cross section calculations a basis set of 16 ortho H2CO states are included, resulting in 62 channels. Resonances are observed at approximately 20.2, 32.7 and 47.7 K. The cross sections are Boltzmann averaged to obtain rate constants which are used to solve the equations of statistical equilibrium. The 6 cm and 2 cm doublets of interstellar H2CO are found to be cooled by collisions with He. The j=3 ortho doublet plays a fundamental role in the cooling of H2CO. Dissert. Abstr.

N76-29108 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STEADY STATE PLASMAPAUSE POSITIONS DEDUCED FROM McILWAIN'S ELECTRIC FIELD MODELS
J. Lemaire 1976 26 p refs Presented at the Phys. of Plasmapause Symp., Grenoble, France, 28 Aug. - 3 Sep. 1975 Submitted for publication
(Aeronomica-Acta-A-161-1976) Avail: Issuing Activity

It has recently been suggested that the plasmasphere of the earth is peeled off near midnight (at L=4.5 for K sub p = 1-2) by plasma elements interchange motion driven by centrifugal or inertial forces. McIlwain's (1974) convection electric field model E3H with a variable scale factor f has been used to calculate different plasmapause positions and shapes. The new theoretical models obtained with f > or = 1.2 are in agreement with observations of whistlers and of the Prognoz satellites, for periods of very low geomagnetic activity (i.e. Ksubp < 1). Furthermore the numerical models corresponding to f < or = 0.7 fit qualitatively the observations of the plasmasphere and plasmapause when the geomagnetic activity has a higher constant level K sub p between 2 and 4. A tentative relation between f and K sub p is deduced. Author (ESA)

N76-29109 Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE PLASMAPAUSE AS A PLASMA SHEATH: A MINIMUM THICKNESS
M. Roth 1976 25 p refs Submitted for publication
(Aeronomica-Acta-A-162-1976) Avail: Issuing Activity

The plasmapause is considered as a stationary boundary layer (a sheath) separating two types of plasmas characterized by different temperatures and densities: on one side, the hot trapped particles imbedded in the cold exospheric plasma of ionospheric origin, and on the other side the plasmatrough including the hot ring current particles. The structure of this layer is described by a kinetic model using the Vlasov-Maxwell's equations for the charged particles and fields. In the absence of any collisional effects or wave-particle interactions a minimum value for the thickness of the plasmapause is deduced which is of the order of 5 times the Larmor radius of the cold ions.
Author (ESA)

N76-29110*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STRUCTURE AND CONTENT OF THE GALAXY AND GALACTIC GAMMA RAYS
Carl E. Fichtel and Floyd W. Stecker Jun. 1976 416 p refs Proc. of an intern. symp. held at Greenbelt, Md., 2-4 Jun. 1976 (NASA-TM-X-71159; X-662-76-154) Avail: NTIS HC $11.00
CSCL 03B

Papers are presented dealing with galactic structure drawing on all branches of galactic astronomy with emphasis on the implications of the new gamma ray observations. Topics discussed include: (1) results from the COS-B gamma ray satellite; (2) results from SAS-2 on gamma ray pulsar, Cygnus X-3, and maps of the galactic diffuse flux; (3) recent data from CO surveys of the galaxy; (4) high resolution radio surveys of external galaxies; (5) results on the galactic distribution of pulsars; and (6) theoretical work on galactic gamma ray emission. For individual titles, see N76-29111 through N76-29132.

N76-29111* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA RAY RESULTS, 1 **c93**
D. J. Thompson, C. E. Fichtel, R. C. Hartman, D. A. Kniffen, G. F. Bignami, R. C. Lamb, H. Oegelman (Middle East Tech. Univ.), M. E. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 1-11C refs (For availability see N76-29110 19-90)
CSCL 03B

Continuing analysis of the data from the SAS-2 high energy gamma-ray experiment has produced an improved picture of the sky at photon energies above 35 MeV. On a large scale, the diffuse emission from the galactic plane is the dominant feature observed by SAS-2. This galactic plane emission is most intense between galactic longitude 310 and 45 deg, corresponding to a region within 7kpc of the galactic center. Within the high-intensity region, SAS-2 observes peaks around galactic longitudes 315 deg, 330 deg, 345 deg, 0 deg, and 35 deg. These peaks appear to be correlated with such galactic features and components as molecular hydrogen, atomic hydrogen, magnetic fields, cosmic ray concentrations, and photon fields.
Author

N76-29112* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA RAY RESULTS. 2. LOCALIZED SOURCES **c93**
R. C. Hartman, C. E. Fichtel, D. A. Kniffen, R. C. Lamb, D. J. Thompson, G. F. Bignami (Milan Univ.), H. Oegelman (Middle East Tech. Univ.), M. E. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 12-22 refs (For availability see N76-29110 19-90)
CSCL 03B

Gamma-ray emission was detected from the radio pulsars PSR1818-04 and PSR1747-46, in addition to the previously reported gamma-ray emission from the Crab and Vela pulsars. Since the Crab pulsar is the only one observed in the optical and X-ray bands, these gamma-ray observations suggest a uniquely gamma-ray phenomenon occurring in a fraction of the radio pulsars. Using distance estimates it is found that PSR1818-04 has a gamma-ray luminosity comparable to that of the Crab pulsar, while the luminosities of PSR1747-46 and the Vela pulsar are approximately an order of magnitude lower. This survey of SAS-2 data for pulsar correlations has also yielded upper limits to gamma-ray luminosity for 71 other radio pulsars. Author

N76-29113* Huygens Laboratium, Leiden (Netherlands).
PRELIMINARY RESULTS FROM THE EUROPEAN SPACE AGENCY'S COS-B SATELLITE FOR GAMMA-RAY ASTRONOMY **c93**
Boudewijn Swanenburg *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 23-38 refs (For availability see N76-29110 19-90)
CSCL 03B

The COS-B satellite carries a single experiment, capable of detecting gamma rays with energies greater than 30 MeV. Its objectives are to study the spatial, energy, and time characteristics of high energy radiation of galactic and extragalactic origin. The capability to search for gamma ray pulsations is enhanced by the inclusion in the payload of a proportional counter sensitive to X-rays of 2-12 Kev. The experiment was calibrated using particle accelerators. The results of these measurements are presented and the performance of the system in orbit is discussed. Author

N76-29114* Commissariat a l'Energie Atomique, Saclay (France).
COS-B OBSERVATIONS OF THE HIGH ENERGY GAMMA RADIATION FROM THE GALACTIC DISC **c93**
Jacques Paul *In* NASA. Goddard Space Flight Center The Galaxy and Galactic Gamma Rays Jun. 1976 p 39-44 refs (For availability see N76-29110 19-90)
CSCL 03B

During the first months of operation, COS-B has observed galactic high energy gamma rays from the galactic disc. In the galactic center and Vela regions the disc emission distribution was measured. From these data the existence of a local (< 1 kpc) and a distant (> 3 kpc) emitting region is apparent in the general direction of the inner galaxy. Author

N76-29115* Max-Planck-Institut fuer Extraterrestrische Physik, Munich (West Germany).
COS-B OBSERVATIONS OF LOCALISED SOURCES OF GAMMA-RAY EMISSION c93
Hans Mayer-Hasselwander *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 45A-51 refs (For availability see N76-29110 19-90)
CSCL 03B

In October 1975 the high energy gamma ray flux from the Vela pulsar was measured by COS-B to be 1.6 to 2.1 times higher than the flux measured by SAS-2 in 1973. The existence is confirmed of a second region of enhanced radiation in the galactic anticenter in addition to that from the Crab pulsar. Author

N76-29116* Palermo Univ. (Italy).
THE TIME STRUCTURE OF THE GAMMA-RAY EMISSION FROM THE CRAB AND VELA PULSARS c93
Rosolino Buccheri *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 52-64 refs (For availability see N76-29110 19-90)
CSCL 03B

High resolution data on the pulsed gamma ray emission from the Crab and Vela pulsars are presented. The light curves of these two pulsars at gamma ray energies show striking similarities. Author

N76-29117* Hulburt (E. O.) Center for Space Research, Washington, D.C.
LOW AND MEDIUM ENERGY GALACTIC GAMMA-RAY OBSERVATIONS c93
Gerald H. Share *In* NASA. Goddard Space Flight Center. The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 65-83 refs (For availability see N76-29110 19-90)
CSCL 03B

Observation of 0.2-100 MeV diffuse gamma radiation emitted from the Galaxy can provide information on the intensities of 5-50 MeV/nucleon cosmic-rays and 50 MeV electrons in interstellar space. Recent measurements of gamma-rays emitted from the galactic center region provide evidence for a diffuse continuum between 10 and 100 MeV. The intensities of the recently reported nuclear line gamma rays, also observed in the direction of the galactic center, require the presence of intense fluxes of low-energy cosmic-rays in the inner Galaxy if the gamma-rays are produced on a galactic scale. Current detection techniques for 0.1-100 MeV gamma-ray measurements are summarized and their capabilities for measuring the diffuse galactic emission are evaluated. Author

N76-29118* Center for Astrophysics, Cambridge, Mass.
VERY HIGH ENERGY GAMMA RAY ASTRONOMY c89
J. E. Grindlay *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 85-107 refs (For availability see N76-29110 19-90)
(CFA/HEA-76-138) CSCL 03A

Recent results in ground based very high energy gamma ray astronomy are reviewed. The various modes of the atmospheric Cerenkov technique are described, and the importance of cosmic ray rejection methods is stressed. The positive detections of the Crab pulsar that suggest a very flat spectrum and time-variable pulse phase are discussed. Observations of other pulsars (particularly Vela) suggest these features may be general. Evidence that a 4.8 hr modulated effect was detected from Cyg X-3 is strengthened in that the exact period originally proposed agrees well with a recent determination of the X-ray period. The southern sky observations are reviewed, and the significance of the detection of an active galaxy (NGC 5128) is considered for source models and future observations. Author

N76-29119* Stanford Univ., Calif. Inst. for Plasma Research.
RADIATION MECHANISMS AND MAGNETOSPHERIC STRUCTURE OF PULSARS c89
P. A. Sturrock and K. B. Baker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 108-117 refs (For availability see N76-29110 19-90)
CSCL 03A

A model of pulsars is outlined. Key early considerations were those which led to the identification of pulsars with neutron stars, the Goldreich-Julian model of pulsar magnetospheres, and the recognition that, in a pulsar magnetosphere, a high energy gamma ray may annihilate to produce an electron-positron pair. Arguments that suggest that pulsar magnetospheres may contain large masses of plasma, a suggestion which has important implications concerning the structure of the magnetosphere, are considered along with observational data which support a magnetosphere model based on that idea rather than the Goldreich-Julian model. Author

N76-29120* Middle East Technical Univ., Ankara (Turkey).
GAMMA RAY PULSARS c89
H. Oegelman, S. Ayasli, and A. Hacinliyan *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 118-127 refs (For availability see N76-29110 19-90)
CSCL 03A

Recent data from the high energy gamma ray experiment have revealed the existence of four pulsars emitting photons above 35 MeV. An attempt is made to explain the gamma ray emission from these pulsars in terms of an electron-photon cascade that develops in the magnetosphere of the pulsar. Although there is very little material above the surface of the pulsar, the very intense magnetic fields correspond to many radiation lengths which cause electrons to emit photons via magnetic bremsstrahlung and these photons to pair produce. The cascade develops until the mean photon energy drops below the pair production threshold which happens to be in the gamma ray range; at this stage the photons break out from the source. Author

N76-29121* Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
DENSITY WAVE THEORY
William W. Roberts, Jr. *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 128-162 refs (For availability see N76-29110 19-90)
CSCL 03B

The prospect that density waves and galactic shock waves are present on the large-scale in disk-shaped galaxies has received support in recent years from both theoretical and observational studies. Large-scale galactic shock waves in the interstellar gas are suggested to play an important, governing role in star formation, molecule formation, and the degree of development of spiral structure. Through the dynamics of the interstellar gas and the galactic shock wave phenomenon, a new insight into the physical basis underlying the morphological classification system of galaxies is suggested. Author

N76-29122* Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
THE GALACTIC DISTRIBUTION (IN RADIUS AND Z) OF INTERSTELLAR MOLECULAR HYDROGEN
N. Z. Scoville, P. M. Solomon (State Univ. of New York, Stony Brook), and D. B. Sanders (State Univ. of New York, Stony Brook) *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 163-176 refs (For availability see N76-29110 19-90)
CSCL 03B

Observations of the galactic longitude and latitude distributions of gamma = 2.6 mm CO emission are presented. Analysis of this spectral line data yields the large scale distribution of molecular clouds in the galactic disk and their z-distribution out of the disk. Strong maxima in the number of molecular clouds occur in the galactic nucleus and at galactic radii 4-8 kpc. The peak at 4-8 kpc correlates well with a region of enhanced 100 Mev gamma ray emissivity. This correlation strongly supports the conclusion that the gamma rays are produced as a result of

cosmic ray interactions in molecular H2 clouds rather than HI. One important implication of this is that the interstellar magnetic field lines to which cosmic rays are confined must therefore not be excluded from these dense clouds. The width of the cloud layer perpendicular to galactic plane between half density points is 105 + or - 15 pc near the 5.5 kpc peak. The total mass of molecular gas in the interior of the galaxy exceeds that of atomic hydrogen. Author

N76-29123* National Radio Astronomy Observatory, Green Bank, W.Va.
REMARKS ON THE OVERALL DISTRIBUTION OF HYDROGEN IN THE GALACTIC DISK
W. B. Burton *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 177-205 refs Sponsored by NSF (For availability see N76-29110 19-90)
CSCL 03B

Several current problems concerning the overall distribution of hydrogen in the galaxy are discussed in general terms. These problems include the degree of saturation characterizing low-latitude emission observations of HI, and the optical-depth corrections to the derived column and volume densities; the amount of fine-scale velocity and spatial structure diluted by the instrumental limitations of the presently available surveys; and the general problem of detailed mapping of the HI in the galaxy. Comparison is made between the distribution of HI and that of CO and several other galactic tracers. The galactic disk as defined by atomic hydrogen has a diameter fully twice as large as that defined by the ionized and molecular states of hydrogen, as well as by other molecules, supernova remnants, pulsars, gamma radiation, synchroton radiation, and the youngest stars. It is also less confined to the galactic equator than most of the other constituents. The degree of small-scale structure apparent in the molecular observations is much greater than in the HI observations. Parameters describing the small-scale structure were determined using Monte Carlo techniques to simulate the observations. Author

N76-29124* Cambridge Univ. (England). Cavendish Lab.
THE NON-THERMAL RADIATION IN THE GALAXY **c93**
J. E. Baldwin *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 206-221 refs (For availability see N76-29110 19-90)
CSCL 03B

The distribution of nonthermal emissivity with height z above the galactic plane is examined. The main result is that recent observations of the distribution of brightness at intermediate latitudes in the galaxy and of the edge-on spiral galaxy NGC 891 indicate that the emissivity extends to heights of several kpc perpendicular to the plane. The relationship between the nonthermal emissivity and the neutral gas is also studied. In several galaxies the angular distributions of neutral hydrogen and nonthermal emission are roughly coextensive and show similar features such as spiral structure. If radio galaxies and normal galaxies with strong nuclear radio sources are excluded, there appears to be a proportionality between their total HI content and their nonthermal radio luminosity. Author

N76-29125* Center for Astrophysics, Cambridge, Mass.
INFRARED ASTRONOMY AND HIGH ENERGY ASTROPHYSICS
G. G. Fazio *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 222-238 refs (For availability see N76-29110 19-90)
CSCL 03B

Observations of the diffuse far infrared flux from the galactic plane as well as far infrared measurements of the properties of dense molecular clouds, when combined with recent high-energy gamma ray measurements and radio observations of carbon monoxide, can yield new information about the total mass of molecular clouds, the large scale structure of the inner galaxy, and the density of cosmic rays. These observations are discussed. Author

N76-29126* Princeton Univ. Observatory, N.J.
ULTRAVIOLET OBSERVATIONS OF LOCAL GAS
E. B. Jenkins *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 239-263 refs (For availability see N76-29110 19-90)
CSCL 03B

From satellite measurements of ultraviolet spectra of stars, an average density of approximately 1.1/cu cm for hydrogen atoms, in both atomic and molecular form, is estimated for regions of space along the galactic plane within about 1 kpc of the sun. About 20% of the atoms are bound in molecular form although this figure is uncertain since the ultraviolet measurements avoid the very dense interstellar clouds. Discrete values for this percentage are observed to vary markedly; regions with less than average density seem to have fractional abundances of H2 several orders of magnitude lower than average. A ratio of CO/H is observed for regions in front of stars observed by the Copernicus satellite. Author

N76-29127* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFUSE GALACTIC GAMMA RAY LINES **c93**
R. E. Lingenfelter and R. Ramaty (Calif. Univ., Los Angeles) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 264-288 refs (For availability see N76-29110 19-90)
(Grant NSF AST-67-08178)
CSCL 03B

The origin and observability were studied of diffuse gamma ray line emission from the galaxy. It was found that such lines could be formed by nuclear excitation interactions of low energy cosmic rays with both interstellar gas and dust grains. The gamma ray emission lines from deexcitation of grain nuclei are sharp with Doppler widths of the order of 10 kev or less; the lines from gas nuclei are also relatively sharp with widths of the order of 100 kev for the most intense line; and the lines from cosmic ray nuclei are broad with widths of the order of several hundred kev. A detailed evaluation is presented of the production rate of the 4.44 Mev line for a variety of assumed cosmic ray spectra. Results are compared with reported galactic gamma ray line intensities and it is concluded that the measurements are consistent with a low energy cosmic ray density which increases toward the galactic center in proportion to the molecular gas density. Author

N76-29128* Illinois Univ., Urbana. Dept. of Astronomy.
GAMMA RAYS AND SUPERNOVA EXPLOSIONS **c93**
W. David Arnett *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 289-298 refs (For availability see N76-29110 19-90)
CSCL 03B

The detection of gamma rays from supernovae will provide interesting tests of current theory. Some current ideas on the expected gamma ray flux, as modified by recent theoretical results are reviewed. Author

N76-29129* Max-Planck-Institut fuer Radioastronomie, Bonn (West Germany).
GALACTIC DISTRIBUTION OF PULSARS **c89**
J. H. Seiradakis *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 299-319 refs (For availability see N76-29110 19-90)
CSCL 03A

The density distributions of pulsars in luminosity, period, Z-distance, and galactocentric distance were derived using a uniform sample of pulsars detected during a 408 MHz pulsar survey at Jodrell Bank. There are indications of a fine scale structure in the spatial distribution and evidence that there is a general correlation with other galactic populations and the overall spiral structure. The electron layer in the galaxy is shown to be wider than the pulsar layer and uniform on a large scale. The number of pulsars in the galaxy was estimated and used to derive the pulsar birthrate. Author

N76-29130* Chicago Univ., Ill. Lab. of Astrophysics and Space Research.
COSMIC RAY PROPAGATION AND CONTAINMENT c93
E. N. Parker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 320-340 refs (For availability see N76-29110 19-90)
CSCL 03B

The cosmic rays, an active gaseous component of the disk of the galaxy, are considered along with their propagation and containment as a part of the general dynamics of the disk. The sources of cosmic rays are a matter of speculation. The disk is inflated by the cosmic ray gas pressure comparable to the magnetic pressure, but the rate of inflation is unknown. The time spent by the individual cosmic ray particles in the disk is inversely proportional to the cosmic ray production rate. It is evident from the decay of Be(1c) that the cosmic rays circulate through a volume of space perhaps ten times the thickness of the gaseous disk, suggesting a magnetic halo extending out approximately 1 kpc from either face of the disk. The cosmic rays may be responsible for the halo by inflating the magnetic fields of the disk. Extension of the fields to 1 kpc would imply a high production rate and short life of cosmic rays in the dense gaseous disk of the galaxy. Author

N76-29131* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS AND LARGE SCALE GALACTIC STRUCTURE c93
D. A. Kniffen, C. E. Fichtel, and D. J. Thompson *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 341-354 refs (For availability see N76-29110 19-90)
CSCL 03B

Many theoretical models were developed in an attempt to explain the spatial structure in the observed emission which results from interactions of energetic cosmic rays with the interstellar gas. The peaks in the observed distribution are remarkably well correlated with longitudes corresponding to tangential directions to known spiral arm features. Based on theoretical and experimental arguments, it is assumed that on the scale of galactic arms the cosmic rays are more intense where the mass of the gas to which they are coupled is greatest. Refining this model with the results of recent surveys of the interstellar gas, a good fit to the observations is obtained whether the cosmic rays are confined to the spiral arms in the disk or are more evenly confined as in a flat halo model. Author

N76-29132* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS, COSMIC RAYS AND GALACTIC STRUCTURE c93
F. W. Stecker *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 357-391 refs (For availability see N76-29110 19-90)
CSCL 03B

Working primarily from the recent SAS-2 observations of galactic gamma rays, the relation of these observations to the large scale distribution of cosmic rays and interstellar gas in the galaxy is reviewed and reexamined. Starting with a discussion of production rates, the case for pion decay being the predominant production mechanism in the galactic disk above 100 MeV is reestablished and it is also pointed out that Compton gamma rays can be a significant source. To facilitate discussion, the concepts of four distinct galactic regions are defined, viz. the nebulodisk, ectodisk, radiodisk and exodisk. Bremsstrahlung and pion decay gamma rays are associated with the first two (primarily the first) regions, and Compton gamma rays and synchrotron radiation are associated with the latter two regions. On a large scale, the cosmic rays, interstellar gas (primarily H2 clouds in the inner galaxy) and gamma ray emissivity all peak in a region between 5 and 6 kpc from the galactic center. This correlation is related to correlation with other population I phenomena and is discussed in terms of the density wave concept of galactic structure. The singular nature of the HI distribution appears to follow the supernova remnant and pulsar distributions in the galaxy. Author

N76-29133*# Linguistic Systems, Inc., Cambridge, Mass.
THE MAGNETIC PROPERTIES OF METEORITES
Ye. G. Guskova Washington NASA Jun. 1976 48 p refs Transl. into ENGLISH of the book "Magnitnyye Svoystva Meteoritov," (Leningrad), Nauka Press, 1972, p 1-108
(Contract NASw-2482)
(NASA-TT-F-792) Avail: NTIS HC $4.00 CSCL 03B

This book presents general information on meteorites of all classes, their morphology, chemical and mineralogical state, and a study of their physical properties. Results of an experimental investigation of the magnetic properties of a large number of meteorites of the largest collections in the Soviet Union are also presented. Author

N76-29134*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EARTH-MOON SYSTEM: DYNAMICS AND PARAMETER ESTIMATION; NUMERICAL CONSIDERATIONS AND PROGRAM DOCUMENTATION Semiannual Progress Report, 17 Aug. 1975 - 17 Feb. 1976
W. J. Breedlove, Jr. Jul. 1976 56 p refs
(Grant NsG-1152)
(NASA-CR-148506; TR-76-M4) Avail: NTIS HC $4.50 CSCL 03C

Major activities included coding and verifying equations of motion for the earth-moon system. Some attention was also given to numerical integration methods and parameter estimation methods. Existing analytical theories such as Brown's lunar theory, Eckhardt's theory for lunar rotation, and Newcomb's theory for the rotation of the earth were coded and verified. These theories serve as checks for the numerical integration. Laser ranging data for the period January 1969 - December 1975 was collected and stored on tape. The main goal of this research is the development of software to enable physical parameters of the earth-moon system to be estimated making use of data available from the Lunar Laser Ranging Experiment and the Very Long Base Interferometry experiment of project Apollo. A more specific goal is to develop software for the estimation of certain physical parameters of the moon such as inertia ratios, and the third and fourth harmonic gravity coefficients. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-29135 Maryland Univ., College Park.
AN INVESTIGATION OF ORGANIC COMPOUNDS IN THE MIGHEI METEORITE Ph.D. Thesis
Patricia Hoffman Buhl 1975 152 p
Avail: Univ. Microfilms Order No. 76-15927

To test the influence of secondary radiation reactions in the formation of amino acids in carbonaceous chondrites, four known meteorite dicarboxylic amino acids and an additional homolog dicarboxylic amino acid were irradiated with gamma rays. The irradiation experiment produced amino acid suites similar to those found in meteorites but in smaller concentrations. The aliphatic and aromatic hydrocarbons of the Mighei meteorite were also examined. The C15 to C26 aliphatic hydrocarbons were primarily n-alkanes with smaller amounts of other isomers. The aromatic hydrocarbons were similar to those previously found in the Murchison meteorite. It is noted that the techniques for determining indigenous amino acids permit an accurate determination of these compounds. This information can be used to understand chemical processes during or after formation of the carbonaceous chondrites. However, the terrestrial or extraterrestrial origin of other classes of meteorite organic compounds is unknown. Dissert. Abstr.

N76-29136 California Univ., Los Angeles.
A STUDY OF PRIMITIVE AND UNUSUAL METEORITES

Ph.D. Thesis
Richard Wayne Bild 1976 254 p
Avail: Univ. Microfilms Order No. 76-15935

Primitive meteorites are identified, the samples and electron microprobe analyses of major minerals are described, and the concentrations of a suite of major and trace elements are determined by instrumental and radiochemical neutron activation analysis. The samples studied and a summary of the results are given. Dissert. Abstr.

N76-29137 California Univ., Berkeley.
THE INFRARED POLARIZATION OF VENUS AND MERCURY Ph.D. Thesis
Robert Landau 1975 107 p
Avail: Univ. Microfilms Order No. 76-15270

A stellar and planetary polarimeter operating between 2-20 microns was used to observe Venus, Mercury, and 16 bright infrared stars. Venus is strongly polarized at 3.5 microns from scattering of sunlight by atmospheric aerosols. The polarization as a function of phase at 3.5 microns is consistent with an aerosol composed of concentrated sulfuric acid. Strong polarization at 5 microns expected from such particles is not observed. Thermal emission from the surface of Mercury at 3.5 microns is polarized an amount consistent with a surface dielectric constant at that wavelength between 3 and 5. Dielectric constants derived at radio wavelengths are smaller. This difference may be due to a change in compaction of the surface particle with linear scale. No certain polarization between 3 and 11 microns was measured for any of the M supergiants, carbon stars or other stars. In the particular case of IRC + 10216 the nature of a scattering envelope is somewhat circumscribed. Author

N76-29138*# Biospherics, Inc., Rockville, Md.
TECHNOLOGY FOR RETURN OF PLANETARY SAMPLES Quarterly Progress Report, 19 Aug. - 31 Oct. 1975
18 Dec. 1975 69 p refs
(Contract NASw-2856)
(NASA-CR-148529) Avail: NTIS HC $4.50 CSCL 03B

The problem of returning a Mars sample to Earth was considered. The model ecosystem concept was advanced as the most reliable, sensitive method for assessing the biohazard from the Mars sample before it is permitted on Earth. Two approaches to ecosystem development were studied. In the first approach, the Mars sample would be introduced into the ecosystem and exposed to conditions which are as similar to the Martian environment as the constitutent terrestrial organisms can tolerate. In the second approach, the Mars sample would be tested to determine its effects on important terrestrial cellular functions. In addition, efforts were directed toward establishing design considerations for a Mars Planetary Receiving Laboratory. The problems encountered with the Lunar Receiving Laboratory were evaluated in this context. A questionnaire was developed to obtain information regarding important experiments to be conducted in the Planetary Receiving Laboratory. Author

N76-29139*# California Univ., Berkeley. Dept. of Physics.
NON-THERMAL 10 MICROMETERS CO2 EMISSION LINES IN THE ATMOSPHERES OF MARS AND VENUS
M. A. Johnson [1975] 19 p refs
(Grants NGR-05-003-452; NGL-05-003-272; NSF AST-75-20353)
(NASA-CR-148159) Avail: NTIS HC $3.50 CSCL 03B

Mechanisms for the excitation of strong 10 micrometer CO2 emission lines seen on Mars and Venus are examined. Line absorption of near IR solar flux directly by CO2 or by H2O with collisional transfer of energy to CO2 are proposed as likely excitation mechanisms. Altitudes for peak 10 micrometer emission are estimated to be near 80 km for Mars and 120 km for Venus. Author

N76-29140*# Martin Marietta Corp., Denver, Colo.
A TITAN EXPLORATION STUDY: SCIENCE, TECHNOLOGY AND MISSION PLANNING OPTIONS, VOLUME 1 Final Report
E. L. Tindle, L. A. Manning, S. R. Sadin, L. E. Edsinger, P. R. Weissman, and B. L. Swenson Jun. 1976 38 p
(Contract NAS2-8885)
(NASA-CR-137846; MCR-76-186-Vol-1) Avail: NTIS HC $4.00 CSCL 03B

Mission concepts and technology advancements that can be used in the exploration of the outer planet satellites were examined. Titan, the seventh satellite of Saturn was selected as the target of interest. Science objectives for Titan exploration were identified, and recommended science payloads for four basic mission modes were developed (orbiter, atmospheric probe, surface penetrator and lander). Trial spacecraft and mission designs were produced for the various mission modes. Using these trial designs as a base, technology excursions were then made to find solutions to the problems resulting from these conventional approaches and to uncover new science, technology and mission planning options. Several mission modes were developed that take advantage of the unique conditions expected at Titan. They include a combined orbiter, atmosphere probe and lander vehicle, a combined probe and surface penetrator configuration and concepts for advanced remote sensing orbiters. Author

N76-29141*# Martin Marietta Corp., Denver, Colo.
A TITAN EXPLORATION STUDY: SCIENCE, TECHNOLOGY, AND MISSION PLANNING OPTIONS, VOLUME 2 Final Report
E. L. Tindle, L. A. Manning, S. R. Sadin, L. E. Edsinger, P. R. Weissman, and B. L. Swenson Jun. 1976 339 p refs
(Contract NAS2-8885)
(NASA-CR-137847; MCR-76-186-Vol-2) Avail: NTIS HC $10.00 CSCL 03B

For abstract, see Vol. 1

N76-29142*# Transemantics, Inc., Washington, D.C.
PRELIMINARY RESULTS OF THE STUDY OF THE LIGHT REGIME IN THE ATMOSPHERE AND ON THE SURFACE OF VENUS
V. S. Avduyevskiy, Yu. M. Golovin, F.S. Zavelevich, V. Ya. Kikhushin, M. Ya. Marov, D. A. Melnikov, Ya. I. Merson, B. Ye. Merson, K. A. Razin, and L. I. Chernoshchekov NASA Aug. 1976 15 p Transl. into ENGLISH "Predvaritelnyye Rezultaty Issledovaniya Svetovog Rezhima v Atmosfere i na Poverkhnosti Venery" (preprint), Acad. Sci. USSR, 1976 13 p
(Contract NASw-2792)
(NASA-TT-F-17148) Avail: NTIS HC $3.50 CSCL 03B

An experiment was conducted to measure the illumination on the planet Venus on board the landing modules (LM) of the Venera-9 and Venera-10 automatic space stations which made soft landings on the Venus surface on October 22 and 25, 1975. Preliminary results of the measurements taken during the entire descent in the atmosphere and on the surface of Venus are presented. Author

N76-29143*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
ANALYSIS OF MARINER 5 RADIO TRACKING DATA Final Technical Report
Irwin I. Shapiro Sep. 1974 31 p refs
(Grant NGR-22-009-366)
(NASA-CR-148482) Avail: NTIS HC $4.00 CSCL 03B

Mariner 5 radio tracking data was analyzed to support the following goals: (1) the determination of the mass of Venus, (2) the determination of, or the placement of a stringent upper bound on, the second order terms in the harmonic expansion of Venus' gravity field; and (3) an independent estimate of the locations of the Deep Space Net tracking stations relative to the coordinate system defined by the orbits of the planets. The rotation vector of Venus was also studied using radar observations of the planet. Author

N76-29144*# Harvard Univ., Cambridge, Mass. Hoffman Lab.
MELTING BEHAVIOR AND PHASE RELATIONS OF LUNAR SAMPLES Semiannual Progress Report, 1 Feb. - 31 Jul. 1976
James Fred Hays 1976 74 p refs
(Grant NGL-22-007-247)
(NASA-CR-148512) Avail: NTIS HC $4.50 CSCL 03B

An attempt was made to show that feldspar would float during melting. Large anorthite crystals were placed beneath a silicate glass representative of liquid in which plagioclase accumulation is thought to have occurred. In less than 3 hours

at 1,300 C, the crystals rose to the top in a Pt crucible 3 cm deep equilibrated in air and in a Mo crucible 1.5 cm deep equilibrated in an H2/CO2 gas stream of log PO2 = -10.9 (below Fe/FeO). These results suggest that lunar crustal formation by feldspar flotation is possible without special recourse to differential sinking of plagioclase versus mafic minerals or selective elutriation of plagioclase. Author

N76-29095* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
MEASUREMENTS OF JUPITER'S LONG-LIVED FEATURES AND CURRENTS
E. J. Reese and Reta F. Beebe *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4 Apr. 1976 p 176-190 refs (For availability see N76-29085 19-89)
(Grants NGL-32-003-001; NSF MPS-75-03734)
CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-29145 Massachusetts Univ., Amherst.
OBSERVATIONS OF THE NEAR-INFRARED SOLAR CORONA AND A NEW INTERFEROMETRIC TELESCOPE TEST Ph.D. Thesis
Raymond Newton Smartt 1976 138 p
Avail: Univ. Microfilms Order No. 76-14723

Observations of the infrared outer solar corona were carried out, two with a balloon-borne infrared scanning coronagraph during balloon flights on October, 1973, and the other, ground-based at the June 30, 1973, total solar eclipse. The performance of the 6-detector coronagraph was evaluated, particularly with regard to its novel dual reflective optical systems. The coronagraph balloon flight radiance data, derived from coronal scans spanning elongations of approximately 3-13 solar radii, and a wavelength range of 2-4 microns, is presented. The eclipse data represents the coronal elongation radiance distribution parallel to the ecliptic, over a range of approximately 2-9 solar radii, at a wavelength of 1 micron. A new two-beam interferometer and its application to the testing of telescopes are also described. The interferometer is positioned at the image of a point source, and forms a spherical reference wavefront by diffraction of part of the incident light. Field tests using both star and laser sources were successful. Dissert. Abstr.

N76-29146*# Alabama Univ., Huntsville.
IONIZATION EFFECTS DUE TO SOLAR FLARE ON TERRESTRIAL IONOSPHERE Final Technical Report
S. T. Wu and Arjun Tan Jul. 1976 32 p refs
(Grant NGR-01-008-015)
(NASA-CR-148476; UAH-RR-188) Avail: NTIS HC $4.00 CSCL 03B

Sudden frequency deviation ionospheric disturbances related to the flares of May 18 and 19, 1973 were observed from the NASA/MSFC high frequency Doppler sounder array system in Huntsville, Alabama. The results are compared with those observed at Table Mountain near Boulder, Colorado and at the University of Hawaii. Author

N76-29147*# Kanner (Leo) Associates, Redwood City, Calif.
ANALYTIC REPRESENTATIONS OF THE COMPONENTS OF VISIBLE SOLAR RADIATION: CLEAR SKY CONDITIONS
R. Dogniaux Washington NASA Aug. 1976 39 p refs Transl. into ENGLISH from Publications of the Institut Royal Meteorologique de Belgique (Belgium), serie a, no. 73, 1964 22 p
(Contract NASw-2790)
(NASA-TT-F-17143) Avail: NTIS HC $4.00 CSCL 03B

An analysis is presented for the visible solar radiation components as a function of the parameters characterizing the transparency of the atmosphere under clear sky conditions. The analysis is shown to lead to formulations well-suited for the numerical treatment of illumination prediction problems. Author

N76-29086* New Mexico State Univ., Las Cruces. Dept. of Astronomy.
NON-LTE PROFILES OF STRONG SOLAR LINES
T. J. Schneeberger and H. A. Beebe *In its* Contrib. of the Observatory of N. Mex. State Univ., Vol. 1, No. 4, Apr. 1976 p 110-122 refs (For availability see N76-29085 19-89)
(Grant NSF LP-43815)
CSCL 03A

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-29148*# Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF HARD COSMIC RAYS IN SEPTEMBER 1973 BY MARS-4, MARS-5 AND MARS-7
Ye. V. Gorchakov, V. A. Ignatev, V. A. Iozenas, T. E. Shvidkovskaya, V. A. Yakovlev, I. V. Getselev, V. I. Tkachenko, G. P. Lyubimov, N. N. Kontor, and N. G. Galachev Washington NASA Jun. 1976 17 p refs Transl. into ENGLISH from Kosm. Issled (USSR), vol. 14, no. 1, Jan. - Feb. 1976 p 65-72
(Contract NASw-2790)
(NASA-TT-F-15488) Avail: NTIS HC $3.50 CSCL 03B

Instrument characteristics and the results of intensity measurements of protons, alpha-particles and nuclei with Z>15, are presented. The measurements were performed by the STS-5 gas-discharge counters (Ep>30 Mev) and Cerenkov counters (Ep>500 Mev/nucleon). The flare initiated on September 7 in a model of spherically symmetrical diffusion leads to the relationship of the diffusion coefficient and the distance. Author

N76-29149*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
POWERFUL BURSTS OF COSMIC GAMMA RADIATION
O. F. Prilutskiy, I. L. Rozental, and V. V. Usov Washington NASA Jul. 1976 43 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (USSR), v. 116, no. 3, Jul. 1975 p 517-538
(Contract NASw-2789)
(NASA-TT-F-16733) Avail: NTIS HC $4.00 CSCL 03B

Observations were made and theoretical models were suggested for bursts of cosmic gamma radiation. The identification of X-ray sources is also discussed. Author

N76-29150# Owens Valley Radio Observatory, Pasadena, Calif.
CRL 2688 AND CRL 618: PROTO-PLANETARY NEBULAE?
K. Y. Lo and Kenneth P. Bechis (Massachusetts Univ., Amherst) 1975 23 p refs
(Contract N00014-67-A-0094-0019; Grant NSF MPS-73-04677)
(AD-A020805; Rept-1975-21) Avail: NTIS CSCL 03/2

2.6 mm CO J = 1 to 0 emission has been detected from the peculiar infrared objects CRL 2688 (the Egg Nebula) and CRL 618. The observed parabolic line-shape can be interpreted as optically thick emission from an uniformly expanding molecular envelope with a size smaller than the telescope beam. The line-width indicates an expansion velocity on the order of 20 km/s. Other molecular lines similar to those observed in the envelope of the carbon star IRC-10216 are also observed in CRL 2688, even though the central star in CRL 2688 has a relatively early spectral type (F5Ia). In CRL 618, the existence of an expanding molecular envelope around a central star with spectral type B0 implies that the central star has evolved within a very short time (~10,000 years) from a cool, perhaps carbon rich star. The presence of mass-loss and the rapid evolution of the central stars suggest that CRL 2688 and CRL 618 may be proto-planetary nebulae. GRA

N76-29111* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA RAY RESULTS, 1
D. J. Thompson, C. E. Fichtel, R. C. Hartman, D. A. Kniffen, G. F. Bignami, R. C. Lamb, H. Oegelman (Middle East Tech. Univ.), M. E. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle

East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 1-11C refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29112* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-2 GALACTIC GAMMA RAY RESULTS. 2. LOCALIZED SOURCES
R. C. Hartman, C. E. Fichtel, D. A. Kniffen, R. C. Lamb, D. J. Thompson, G. F. Bignami (Milan Univ.), H. Oegelman (Middle East Tech. Univ.), M. E. Oezel (Middle East Tech. Univ.), and T. Tuemer (Middle East Tech. Univ.) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 12-22 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29113* Huygens Laboratium, Leiden (Netherlands).
PRELIMINARY RESULTS FROM THE EUROPEAN SPACE AGENCY'S COS-B SATELLITE FOR GAMMA-RAY ASTRONOMY
Boudewijn Swanenburg *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 23-38 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29114* Commissariat a l'Energie Atomique, Saclay (France).
COS-B OBSERVATIONS OF THE HIGH ENERGY GAMMA RADIATION FROM THE GALACTIC DISC
Jacques Paul *In* NASA. Goddard Space Flight Center The Galaxy and Galactic Gamma Rays Jun. 1976 p 39-44 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29115* Max-Planck-Institut fuer Extraterrestrische Physik, Munich (West Germany).
COS-B OBSERVATIONS OF LOCALISED SOURCES OF GAMMA-RAY EMISSION
Hans Mayer-Hasselwander *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 45A-51 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29116* Palermo Univ. (Italy).
THE TIME STRUCTURE OF THE GAMMA-RAY EMISSION FROM THE CRAB AND VELA PULSARS
Rosolino Buccheri *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 52-64 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29117* Hulburt (E. O.) Center for Space Research, Washington, D.C.
LOW AND MEDIUM ENERGY GALACTIC GAMMA-RAY OBSERVATIONS
Gerald H. Share *In* NASA. Goddard Space Flight Center. The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 65-83 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29124* Cambridge Univ. (England). Cavendish Lab.
THE NON-THERMAL RADIATION IN THE GALAXY
J. E. Baldwin *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 206-221 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29127* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFUSE GALACTIC GAMMA RAY LINES
R. E. Lingenfelter and R. Ramaty (Calif. Univ., Los Angeles) *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 264-288 refs (For availability see N76-29110 19-90)
(Grant NSF AST-67-08178)
CSCL 03B

N76-29128* Illinois Univ., Urbana. Dept. of Astronomy.
GAMMA RAYS AND SUPERNOVA EXPLOSIONS
W. David Arnett *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 289-298 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29130* Chicago Univ., Ill. Lab. of Astrophysics and Space Research.
COSMIC RAY PROPAGATION AND CONTAINMENT
E. N. Parker *In* NASA. Goddard Space Flight Center The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 320-340 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29131* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS AND LARGE SCALE GALACTIC STRUCTURE
D. A. Kniffen, C. E. Fichtel, and D. J. Thompson *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 341-354 refs (For availability see N76-29110 19-90)
CSCL 03B

N76-29132* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAYS, COSMIC RAYS AND GALACTIC STRUCTURE
F. W. Stecker *In its* The Struct. and Content of the Galaxy and Galactic Gamma Rays Jun. 1976 p 357-391 refs (For availability see N76-29110 19-90)
CSCL 03B

99 GENERAL

N76-29151# Committee on Science and Technology (U. S. House).
ASTRONAUTS AND COSMONAUTS BIOGRAPHICAL AND STATISTICAL DATA, REVISED 31 MAY 1976
Marcia Smith Washington GPO 1976 183 p Rept. for Comm. on Sci. and Technol., 94th Congr., 2d Sess., Jul. 1976 Prepared by the Library of Congr., Sci. Policy Res. Div.
(GPO-72-750) Avail: SOD HC $1.90

Biographical data is presented for U.S. astronauts and Soviet cosmonauts. Photographs are included. Information regarding the U.S. and Soviet space programs is also presented, including data on the manned space flights of each country. D.M.L.